Better Buildings®
U.S. DEPARTMENT OF ENERGY

Better Buildings Residential Network
Peer Exchange Call Series

People Matter: Latest Insights on How to Design Effective Energy Efficiency and Carbon Reduction Programs

August 11, 2022

U.S. DEPARTMENT OF ENERGY

Agenda and Ground Rules

- Agenda Review and Ground Rules
- Opening Poll
- Residential Network Overview and Upcoming Call Schedule
- Featured Speakers
  - **Beth Karlin**, See Change Institute
  - **Inês Azevedo**, Stanford University
  - **Reuven Sussman**, American Council for an Energy-Efficient Economy
- Open Discussion
- Closing Poll and Announcements

Ground Rules:

1. **Sales of services and commercial messages are not appropriate** during Peer Exchange Calls.
2. Calls are a safe place for discussion; **please do not attribute information to individuals** on the call.

The views expressed by speakers are their own, and do not reflect those of the Dept. of Energy.

Join the Network

Member Benefits:

- Recognition in media, social media and publications
- Speaking opportunities
- Updates on latest trends
- Voluntary member initiatives
- One-on-One brainstorming conversations

Commitment:

- Members only need to provide *one number*: their organization's number of residential energy upgrades per year, or equivalent.

Upcoming Calls (2nd & 4th Thursdays):

- *09/08: Insulation Update – Carbon, Hemp, Health and Air Sealing Advances*
- *09/22: Ups and Downs in Energy Markets: How Do Market Fluctuations and Uncertainties Affect Residential Efficiency Investments?"*
- *10/13: How to find DOE Funding for Residential Energy Efficiency*

Peer Exchange Call summaries are posted on the Better Buildings website a few weeks after the call

Beth Karlin

See Change Institute

U.S. DEPARTMENT OF ENERGY

People Matter:

Insights on How to Design Effective Energy Efficiency and Carbon Reduction

Dr. Beth Karlin

bkarlin@seechangeinstitute.com

We specialize in **Research, Strategy, Design**, and **Evaluation** of environmental and health behavior change.

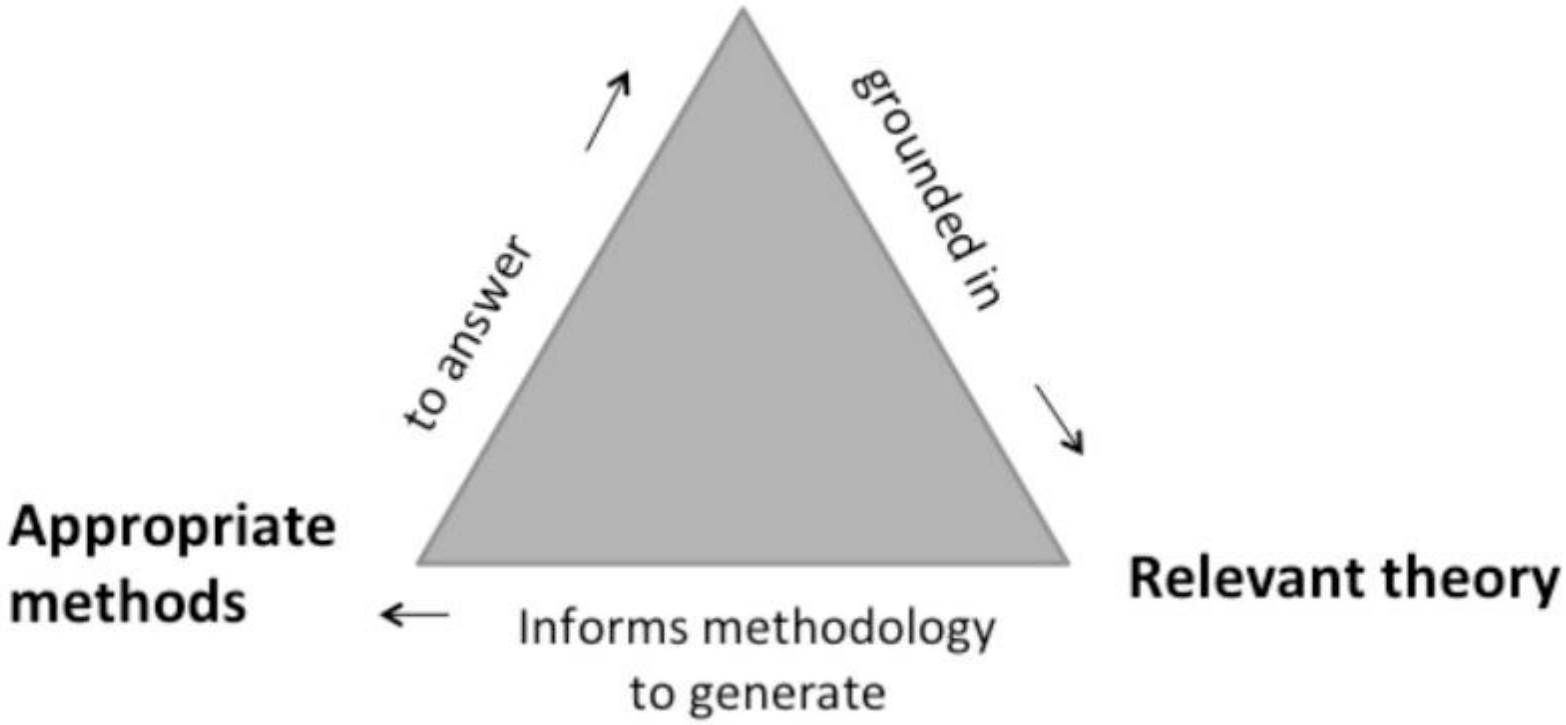
But first…

Why behavioral science?

Why behavioral science?

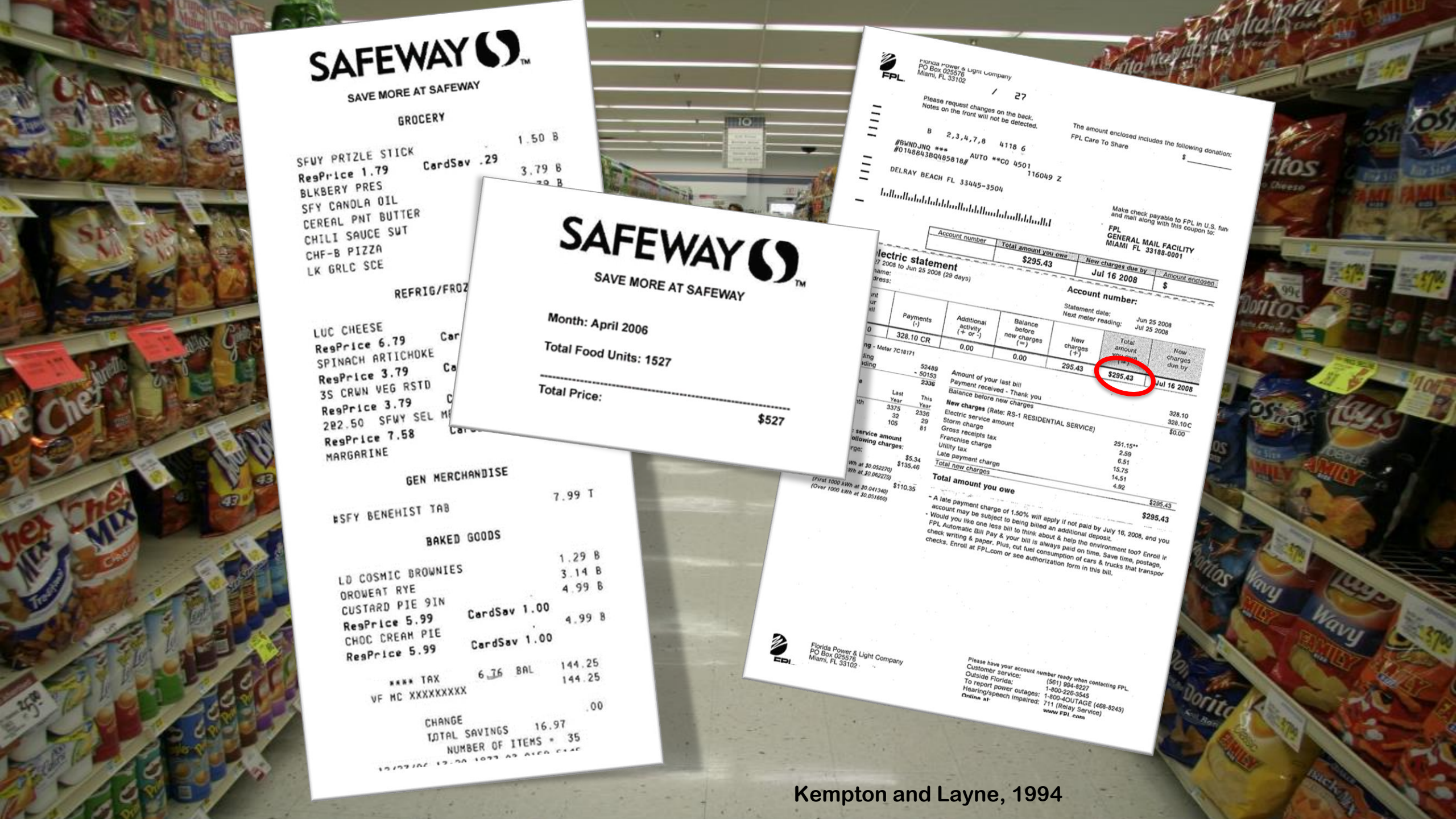
So how can behavioral science help?

Clear research questions



What's the Alternative?

seechange



Kempton and Layne, 1994

HOW Is Feedback Effective?

- 100+ studies conducted since 1976
- Total n = 256,536 (mean 119/study)
- Mean r-effect size = .1174 ($p < .001$)
- Average energy savings: 9%

Significant variability in effects
(from **negative** to **over 20%** savings)

Karlin, Ford & Zinger. (2015) The Effects of Feedback on Energy Conservation: A Preliminary Theory and Meta-Analysis. Psychological Bulletin

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HOW Is Feedback Effective?

Moderators identified in meta-analysis:

WHO?

Study population

HOW LONG?

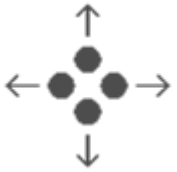
Study duration

HOW OFTEN?

Frequency of feedback

WHAT TYPE?

Feedback medium



WHAT LEVEL?

Disaggregation

WHAT MESSAGE?

Comparison

Karlin, Ford & Zinger. (2015) The Effects of Feedback on Energy Conservation: A Preliminary Theory and Meta-Analysis. Psychological Bulletin

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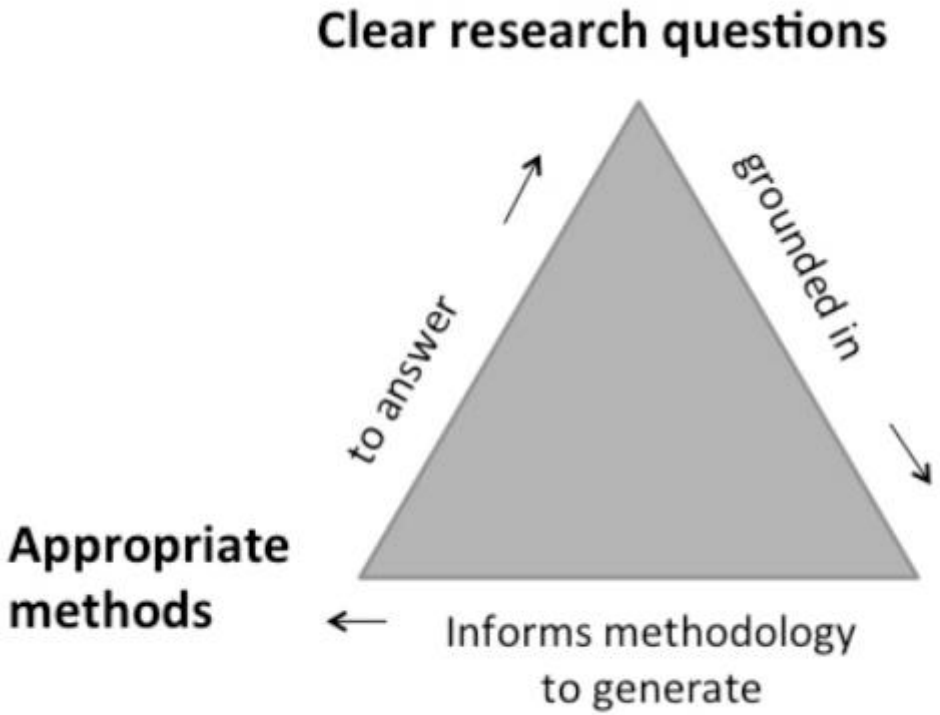

Relevant Theory

Common Strategies

Information

Motivation

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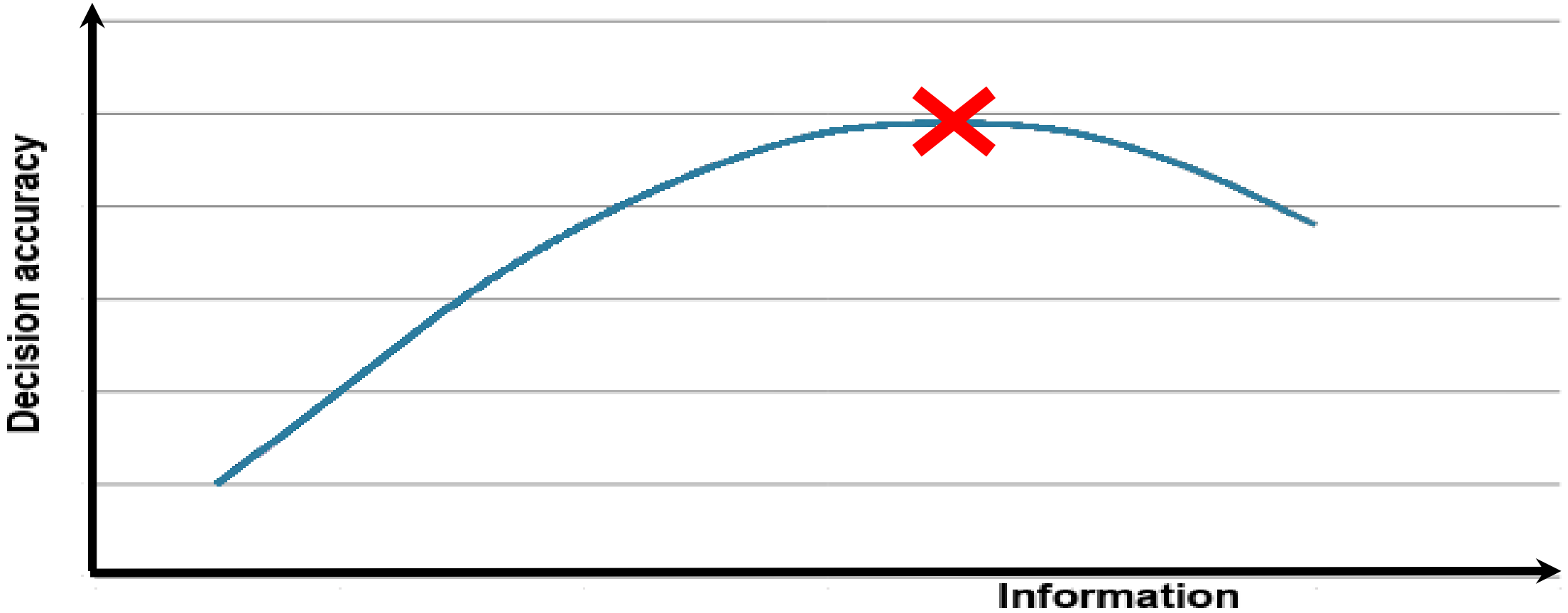
Connect the dots.



Miller, 1956

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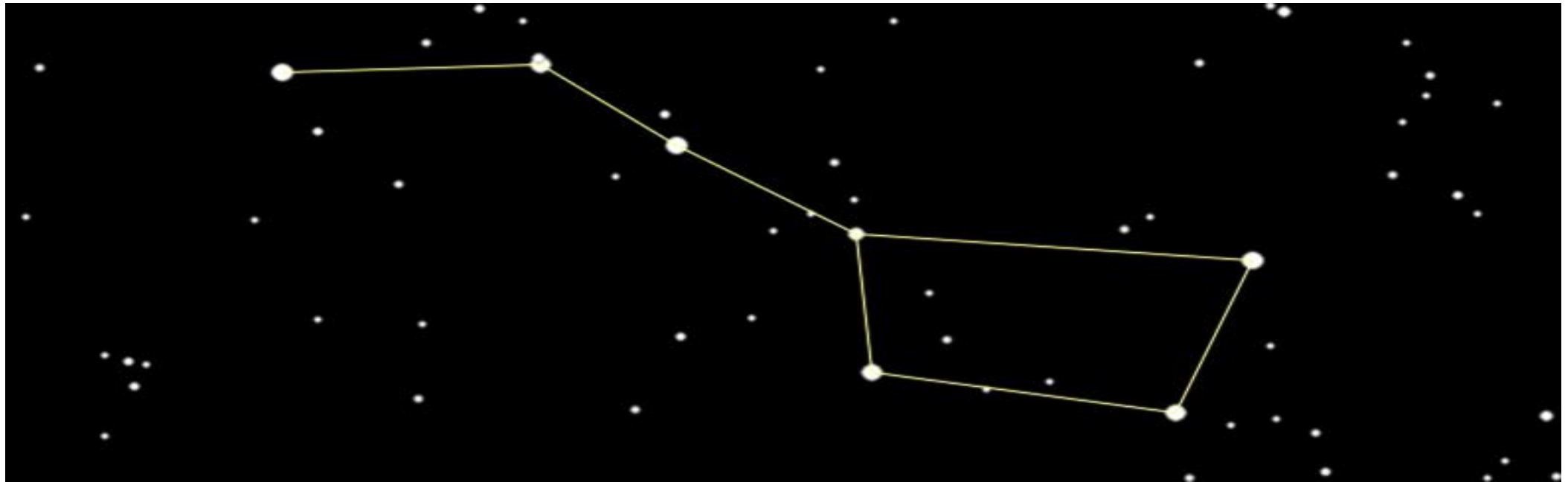

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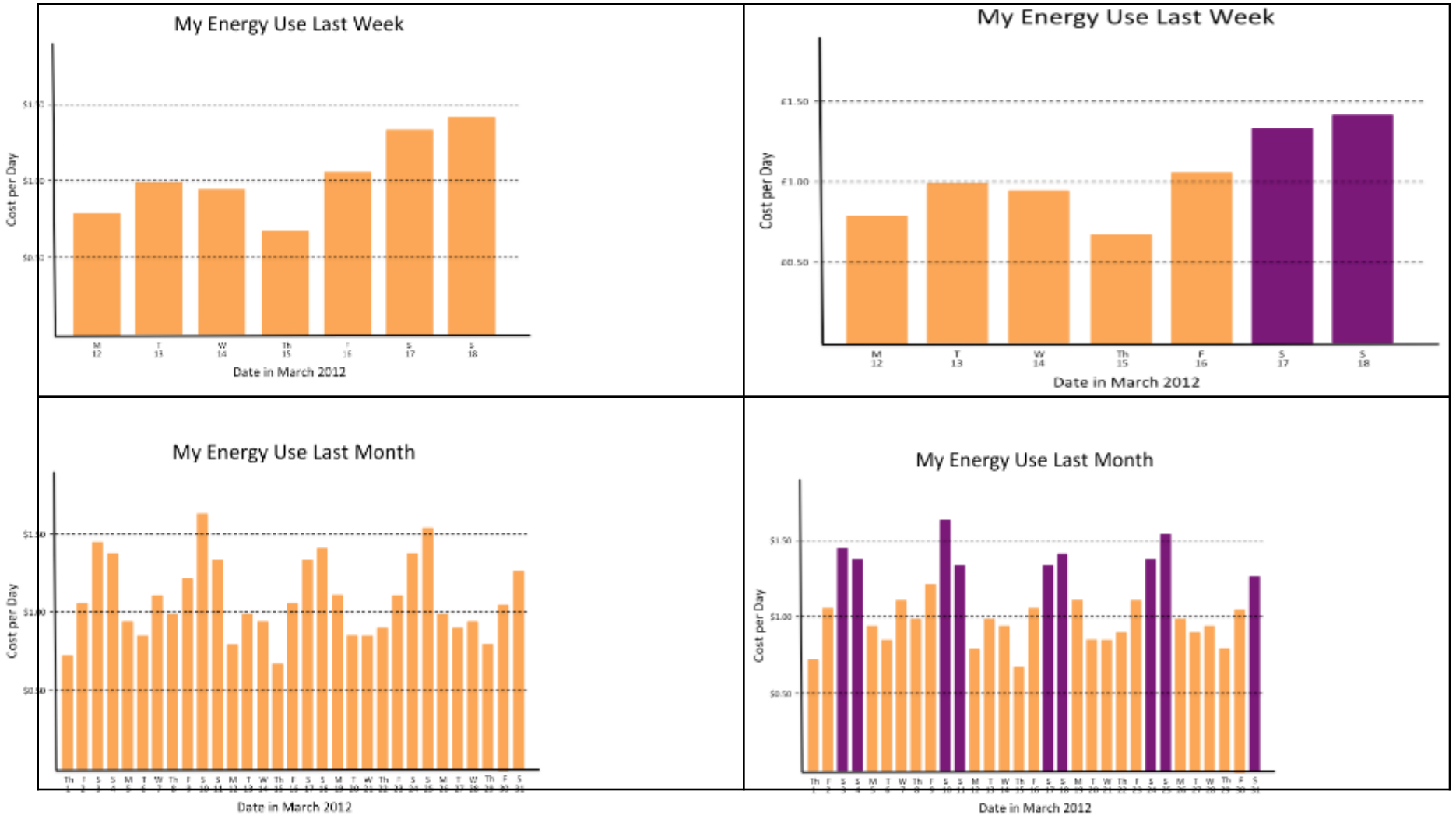

Ford & Karlin, 2013

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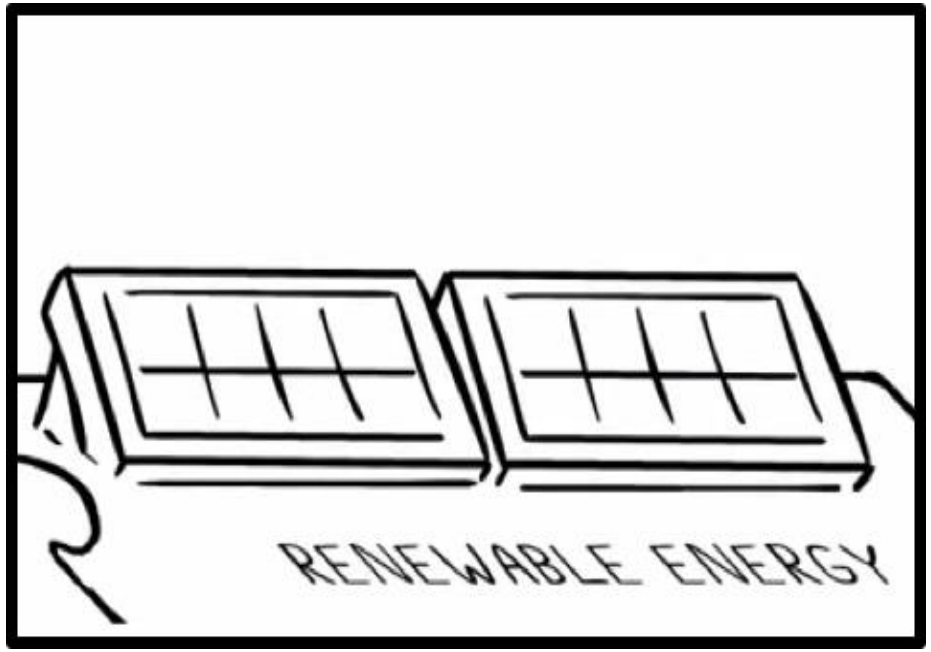
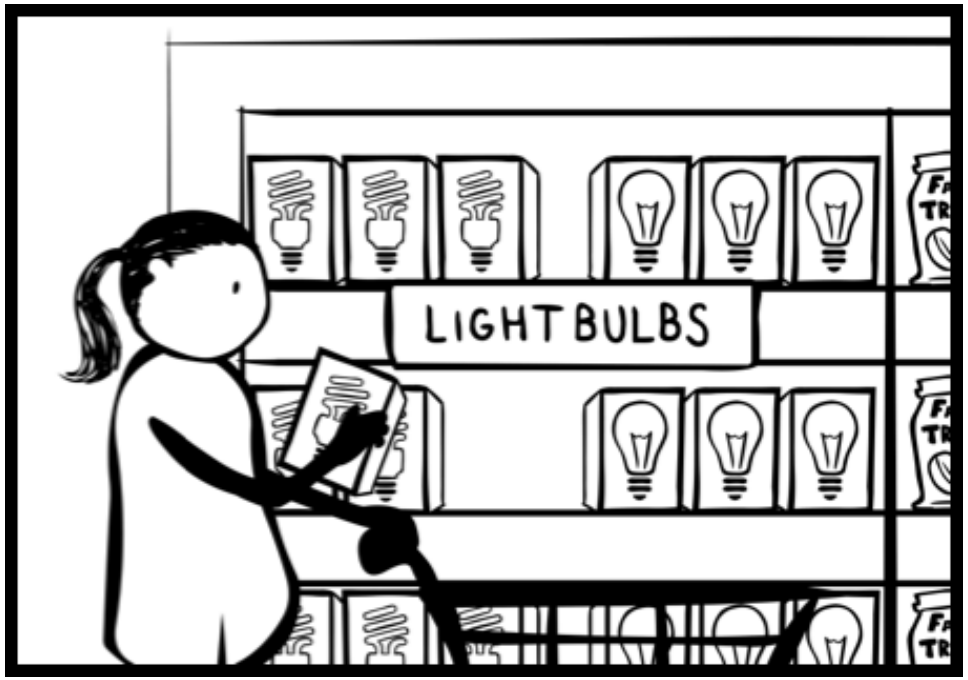
Show that it matters.

Behavioral Efficacy



Can I do it?

Response Efficacy



Will it matter?

Rogers Protection Motivation Theory, 1983

Show that it matters

ONE MEAL A DAY

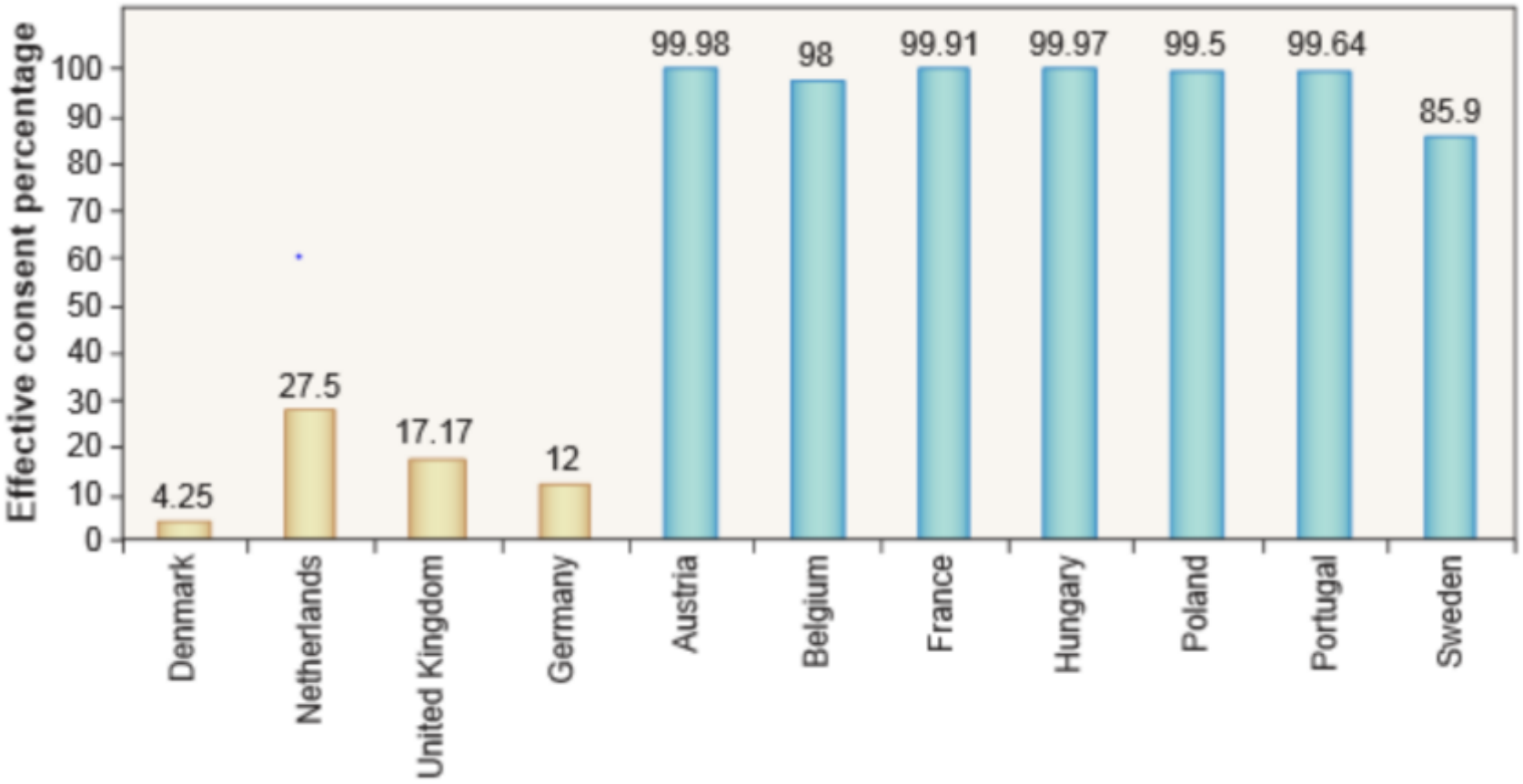
OMD

FOR THE PLANET

Just one person, eating one plant based meal a day for a year, will save almost 200,000 gallons of water and the equivalent of carbon in driving from Los Angeles to New York City.

– Suzy Amis Cameron

Make no decision the best decision.



Johnson & Goldstein, 2003

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Make no decision the best decision.

THE **100% RENEWABLE ENERGY DEFAULT** IS ONE OF THE EASIEST, MOST COST-EFFECTIVE, IMMEDIATE, AND SIGNIFICANT WAYS FOR COMMUNITIES TO ACT ON CLIMATE AND REDUCE EMISSIONS

Appropriate Methods

Research Methods

Qualitative

- Usability (UX) Testing
- Focus Groups / Interviews
- Ethnography
- Content Analysis

Quantitative

- Experimental (AB) Testing
- Regression Analysis
- Segmentation Analysis
- Structural Equation Modeling

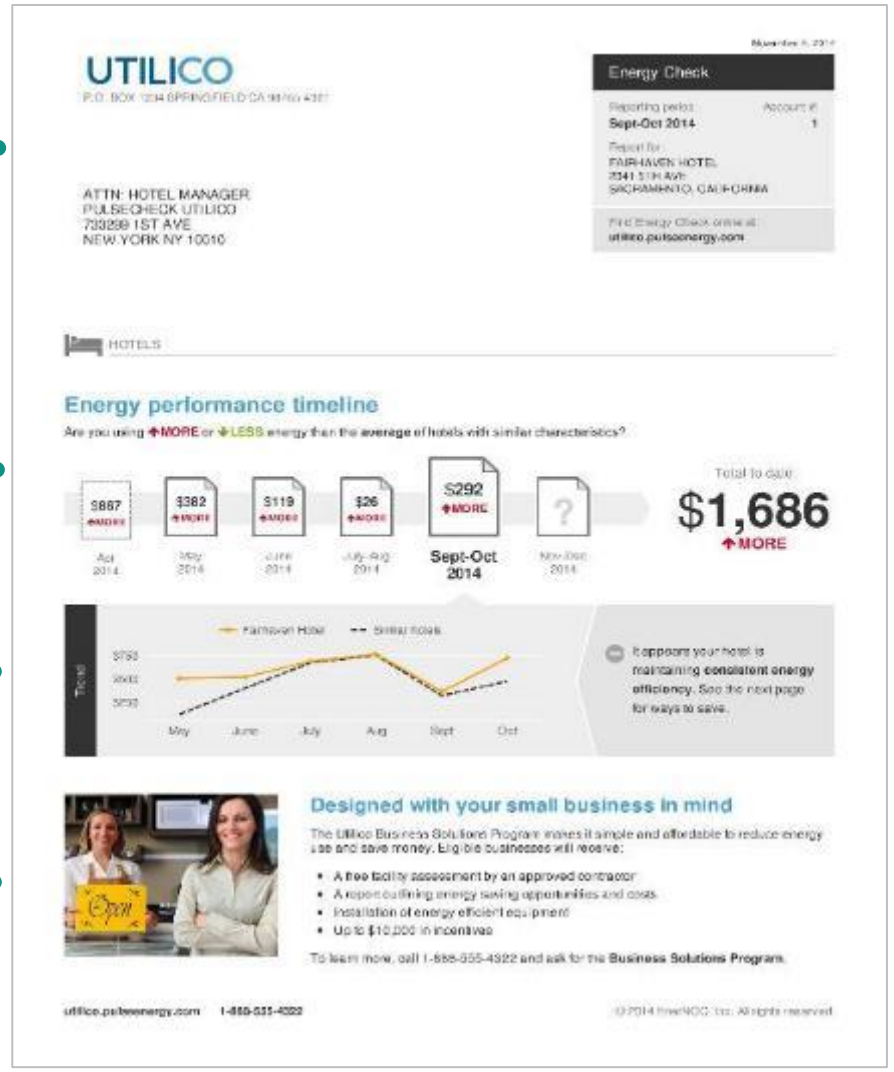
Case Study: Business Energy Reports (BERs)

Personalization

Feedback

Social Norms

Identity



Icons

Photos

Gain/Loss Framing

seechange

Case Study: Business Energy Reports (BERs)

Icons

Photos

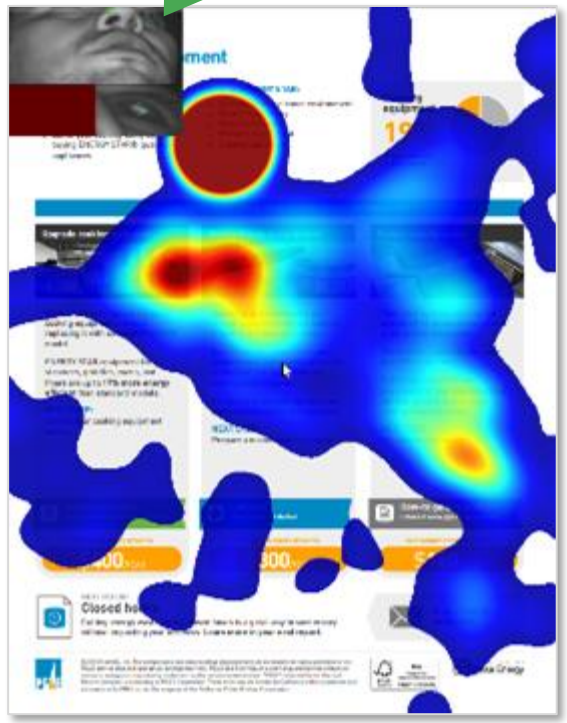
Gain/Loss Framing

seechange

Case Study: Business Energy Reports (BERs)

"It would be helpful to have someone **show me what I can change** here."

"I just scan this and then **throw it out**. Sorry."



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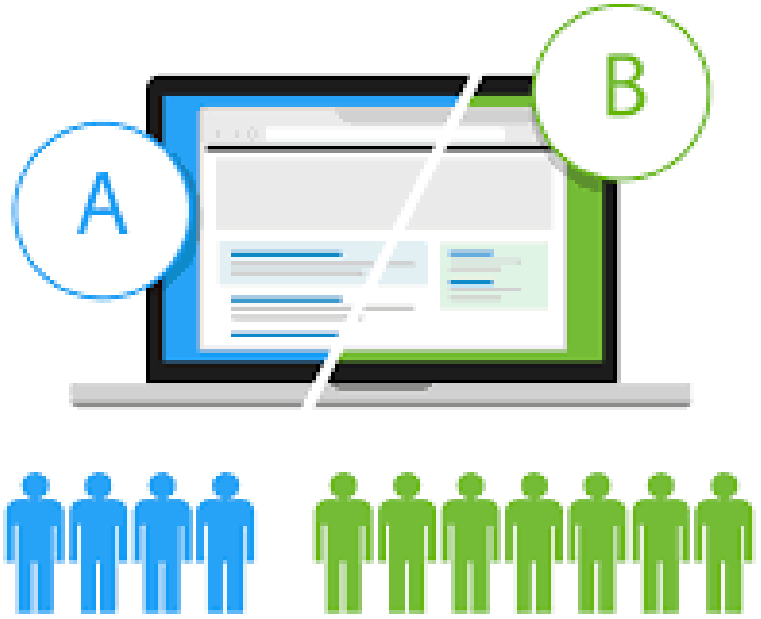

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Case Study: Business Energy Reports (BERs)

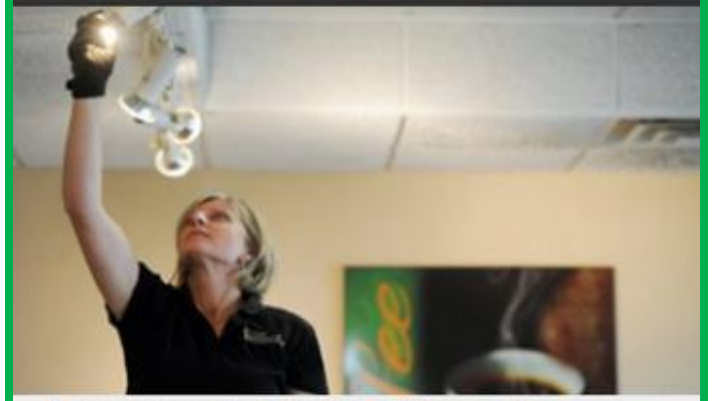
Lighting maintenance

Make sure that bulbs, fixtures, lamps, and reflective surfaces are **cleaned regularly**.

By removing dust and grease, you can **increase the output** of your lights. Without maintenance, light levels can fall by more than 50% in 2-3 years.

A basic maintenance program can reduce lighting electricity costs **by up to 15%**.

Lighting maintenance



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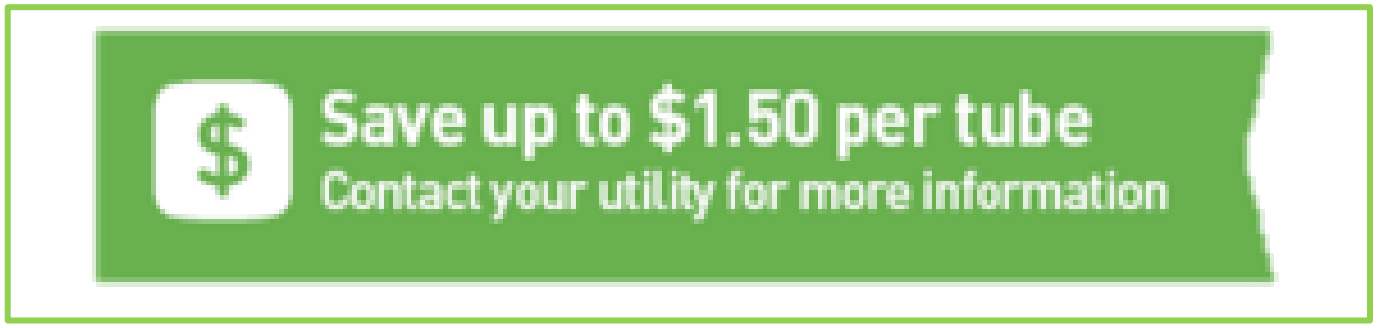

More at: http://homeenergy.org/show/blog/id/917/

Case Study: Business Energy Reports (BERs)

Personalization

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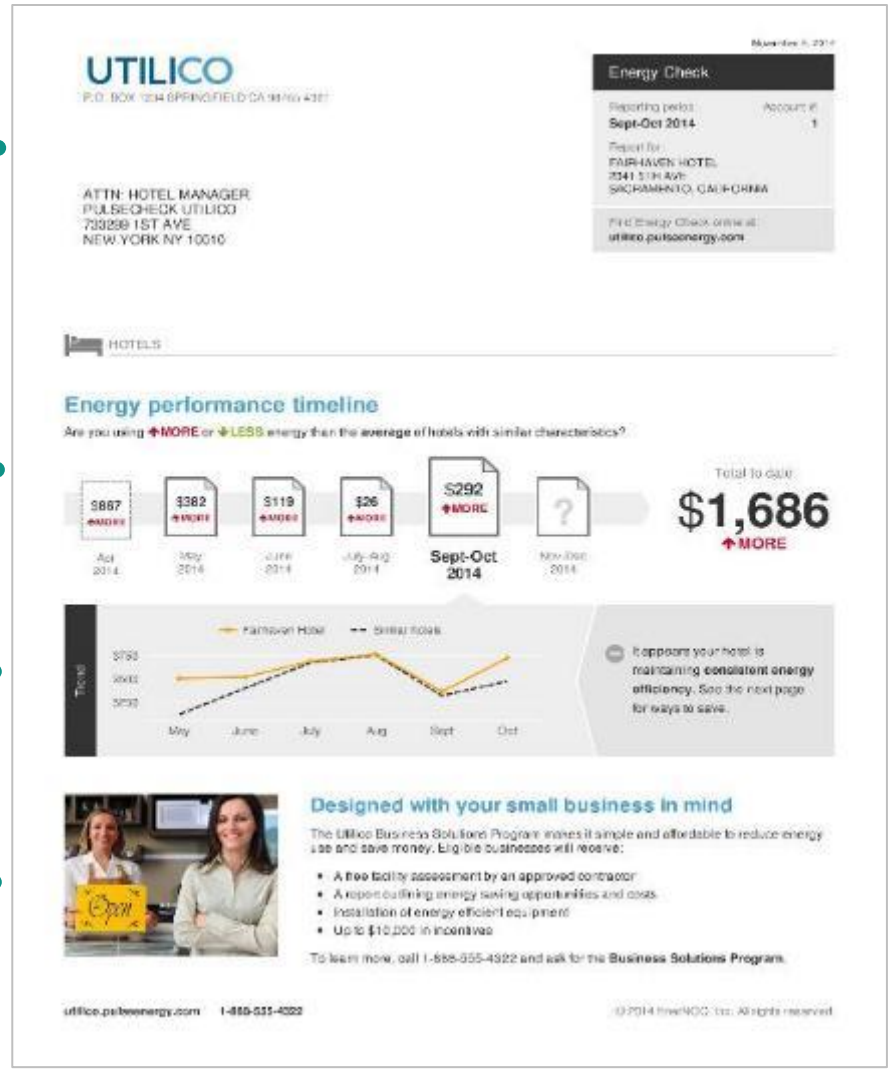
Social Norms

Identity



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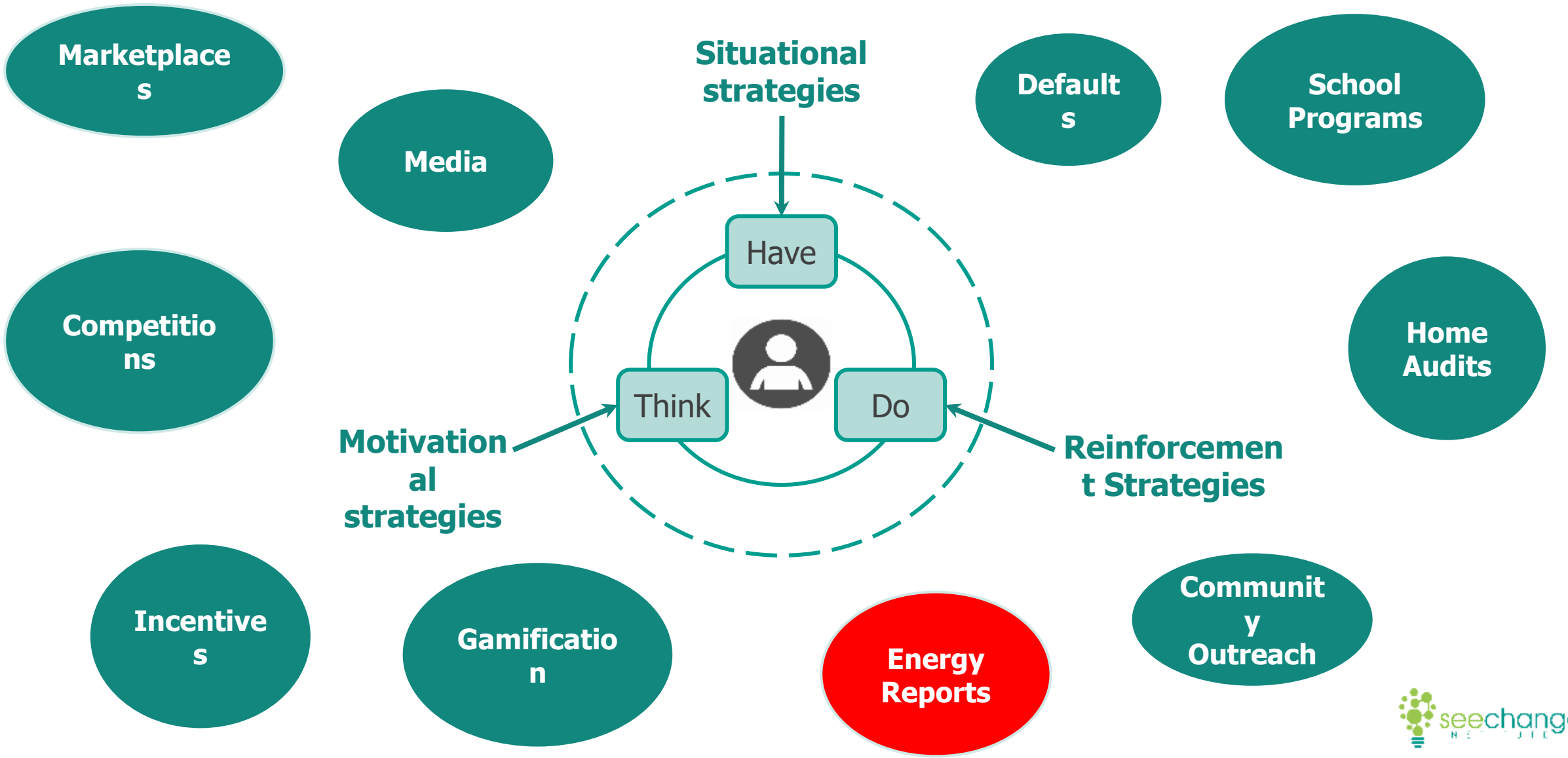
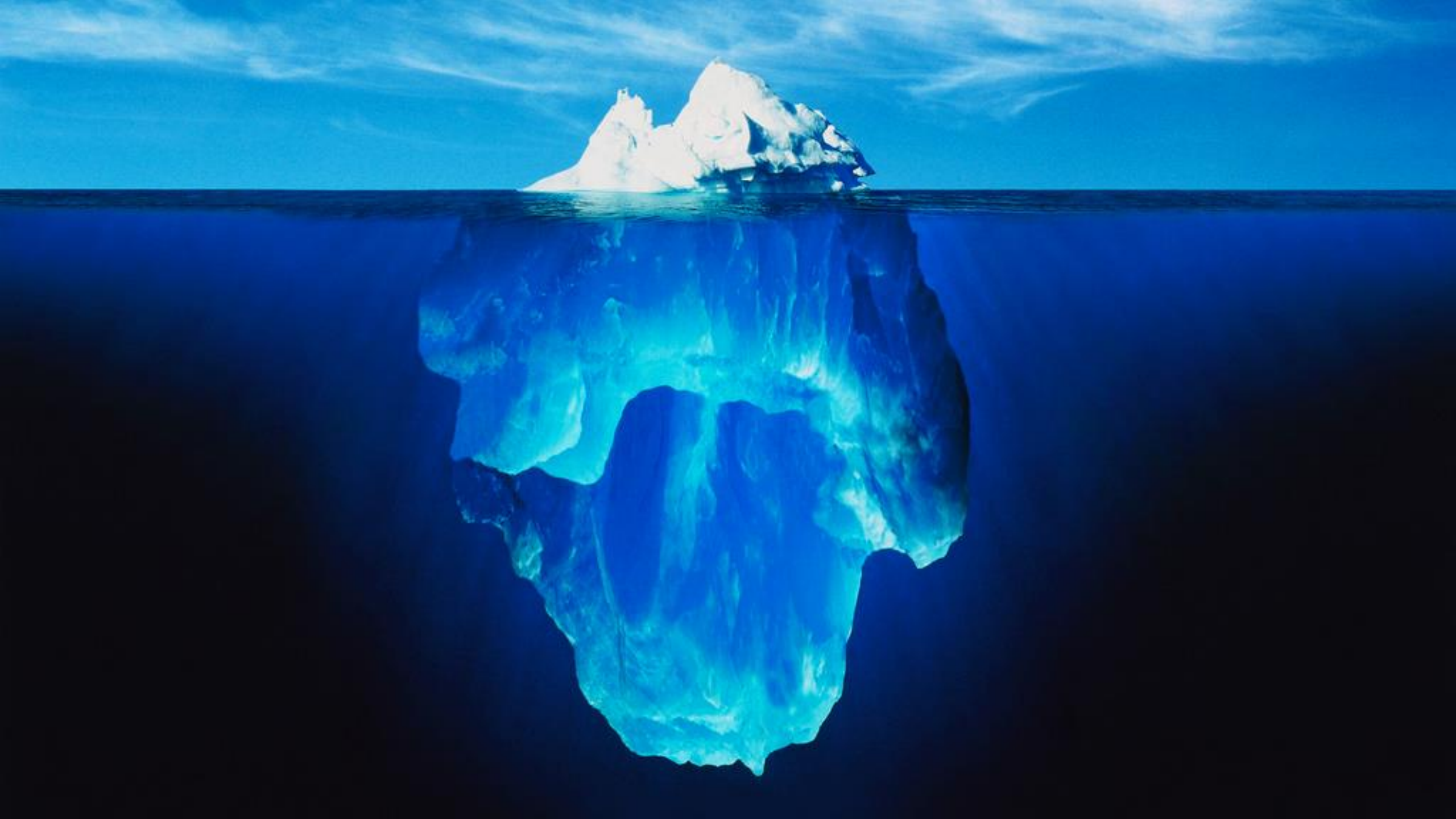
Program Ecosystem





SCIENCE
IS MY
SUPER
POWER

Thank you!

Dr. Beth Karlin

bkarlin@seechangeinstitute.com

Inês Azevedo

Stanford University

U.S. DEPARTMENT OF ENERGY

Stanford | SCHOOL OF EARTH, ENERGY & ENVIRONMENTAL SCIENCES

Stanford | Doerr School of Sustainability

ENERGY RESOURCES ENGINEERING

DEP. ENERGY SCIENCE & ENGINEERING

Webinar theme: "What Are Best Practices in Behavior Change for Energy Efficiency & Carbon Reduction"

Inês M.L. Azevedo

Associate Professor, Department of Energy Resources Engineering

Co-director, Bits & Watts Initiative Stanford

Senior Fellow, Woods Institute for the Environment

Senior Fellow, Precourt Energy Institute

Stanford University

https://ines.stanford.edu

Key messages

1. People are not very good at assessing their energy consumption or carbon footprint.
2. Feedback on information may not be enough to change behavior.
3. Rebound effects may exist but the are likely small.
4. Providing information on co-benefits may help with better decision making.
5. To understand the impacts of emissions we may need very geographical and temporally specific emissions data.

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Experiment with households to understand perceptions of energy use versus actual energy use.

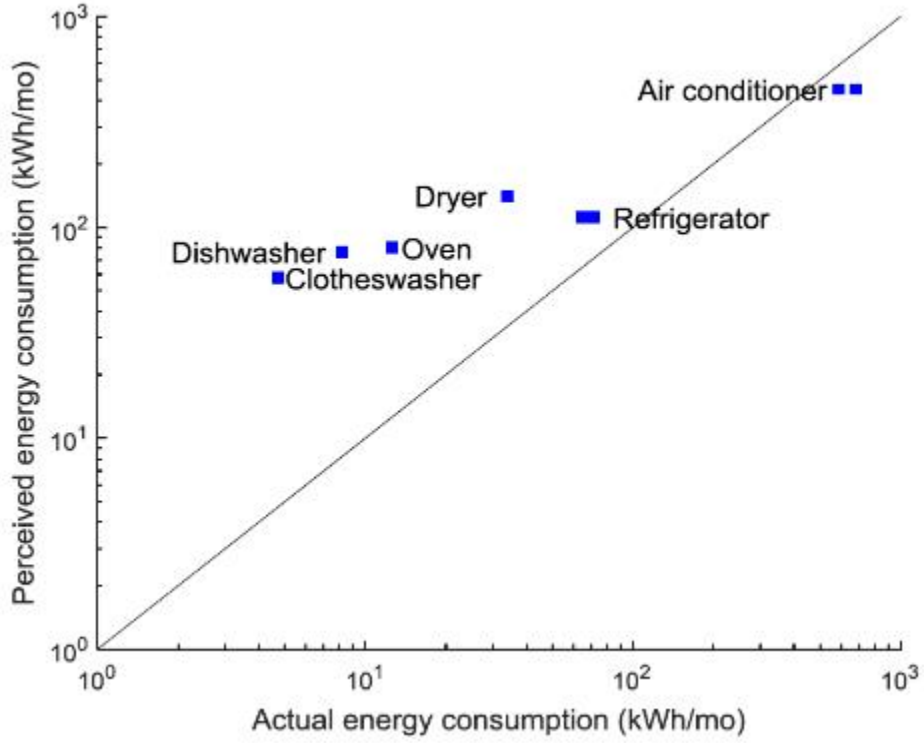
Strategies for reducing residential energy consumption that encourage efficient energy use may rely on informed investment and operational decisions by households.

These strategies may be ineffective if consumers are unaware of how much electricity is used by different devices in their homes and buildings.

We compared consumers' perceptions of their appliances' electricity use to these appliances' actual circuit level direct-metered electricity consumption using an online survey.

118 homeowners from Austin, Texas were asked to estimate the energy consumption of six household devices during an average summer month.

Participants overestimated the energy consumed by their low energy consuming devices and slightly underestimated that of their most energy-consuming device.



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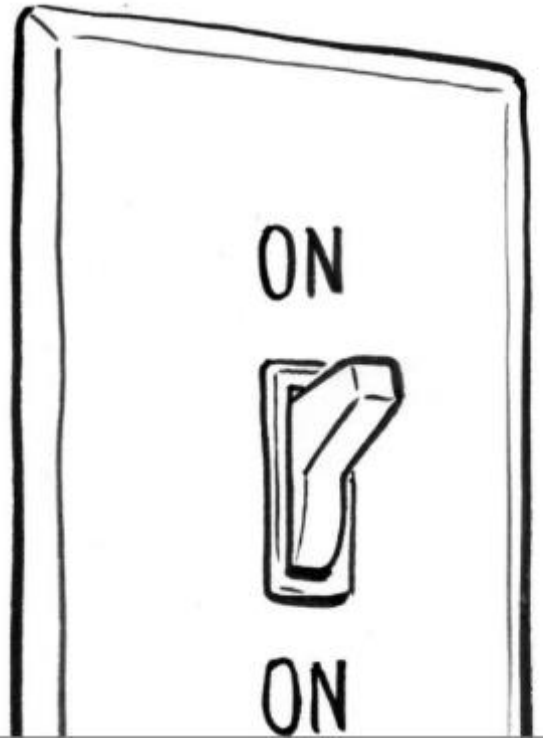
Will these energy saving be achieved?

Every so often the debate on “rebound effects” re-emerges…

The Opinion Pages | OP-ED CONTRIBUTORS

The Problem With Energy Efficiency

By MICHAEL SHELLENBERGER and TED NORDHAUS OCT. 8, 2014



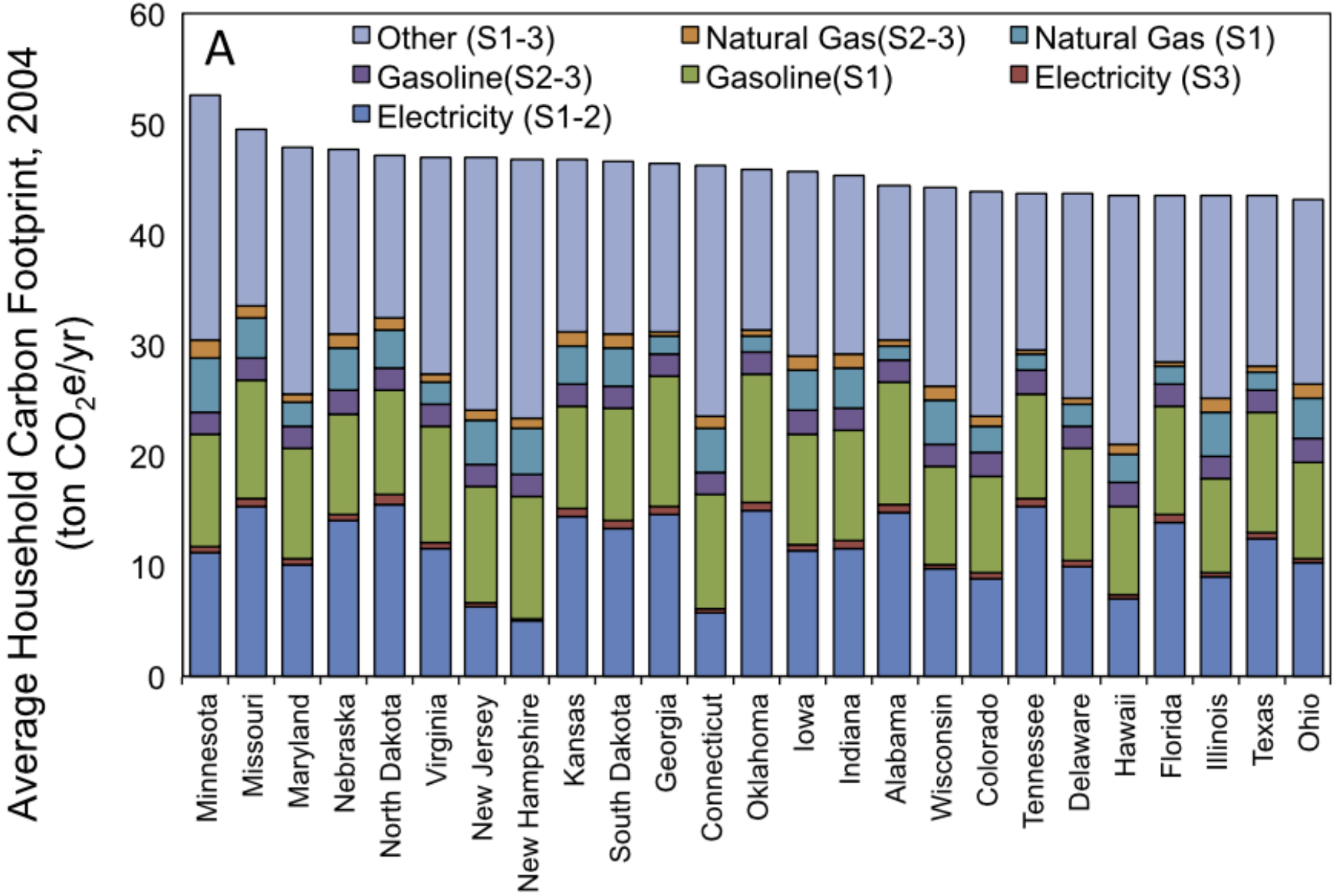
OAKLAND, Calif. — ON Tuesday, the Royal Swedish Academy of Sciences awarded the 2014 Nobel Prize in Physics to three researchers whose work contributed to the development of a radically more efficient form of lighting known as light-emitting diodes, or LEDs.

In announcing the award, the academy said, “Replacing light bulbs and fluorescent tubes with LEDs will lead to a drastic reduction of electricity requirements for lighting.” The president of the Institute of Physics noted: “With 20 percent of the world’s electricity used for lighting, it’s been calculated that optimal use of LED lighting could reduce this to 4 percent.”

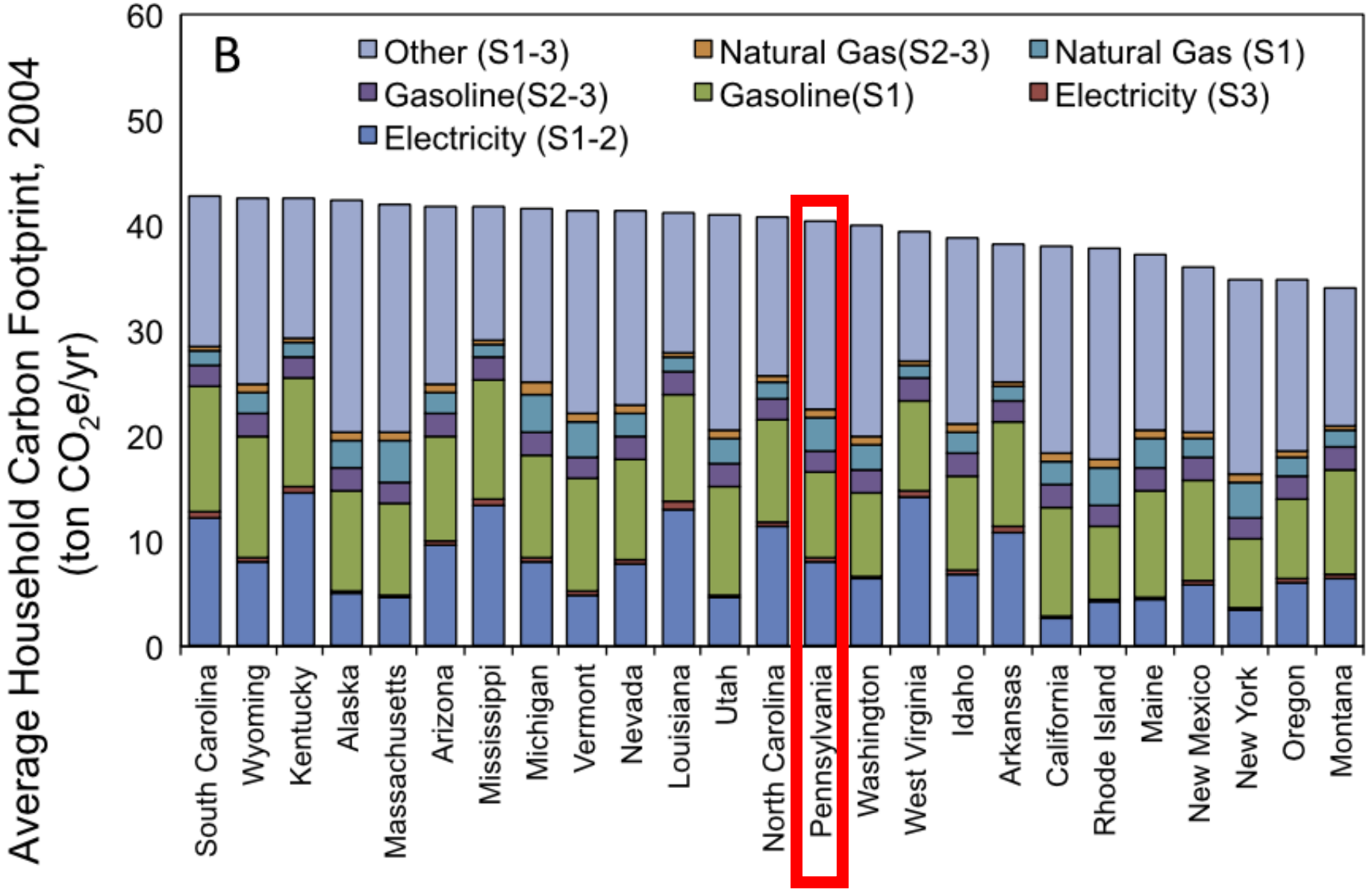
The winners, Shuji Nakamura, an American, and Isamu Akasaki and Hiroshi Amano, both from Japan, justly

We have been working on several aspects of this “rebound effects” problem over the course of the last couple of years, and setting up a coherent research agenda:

Combining micro-econ with LCA



Thomas, Zeckhauser, Azevedo, ERL.



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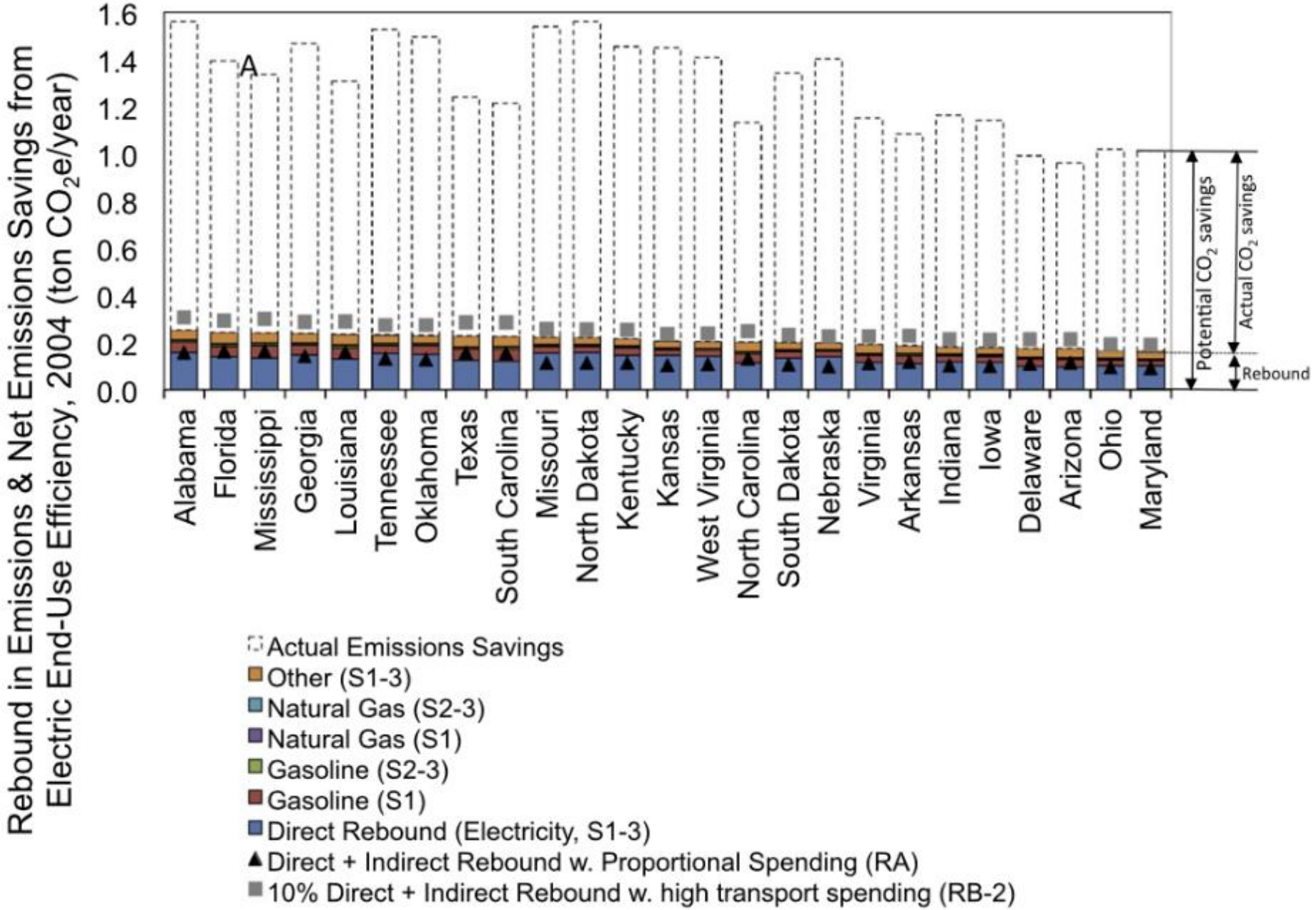

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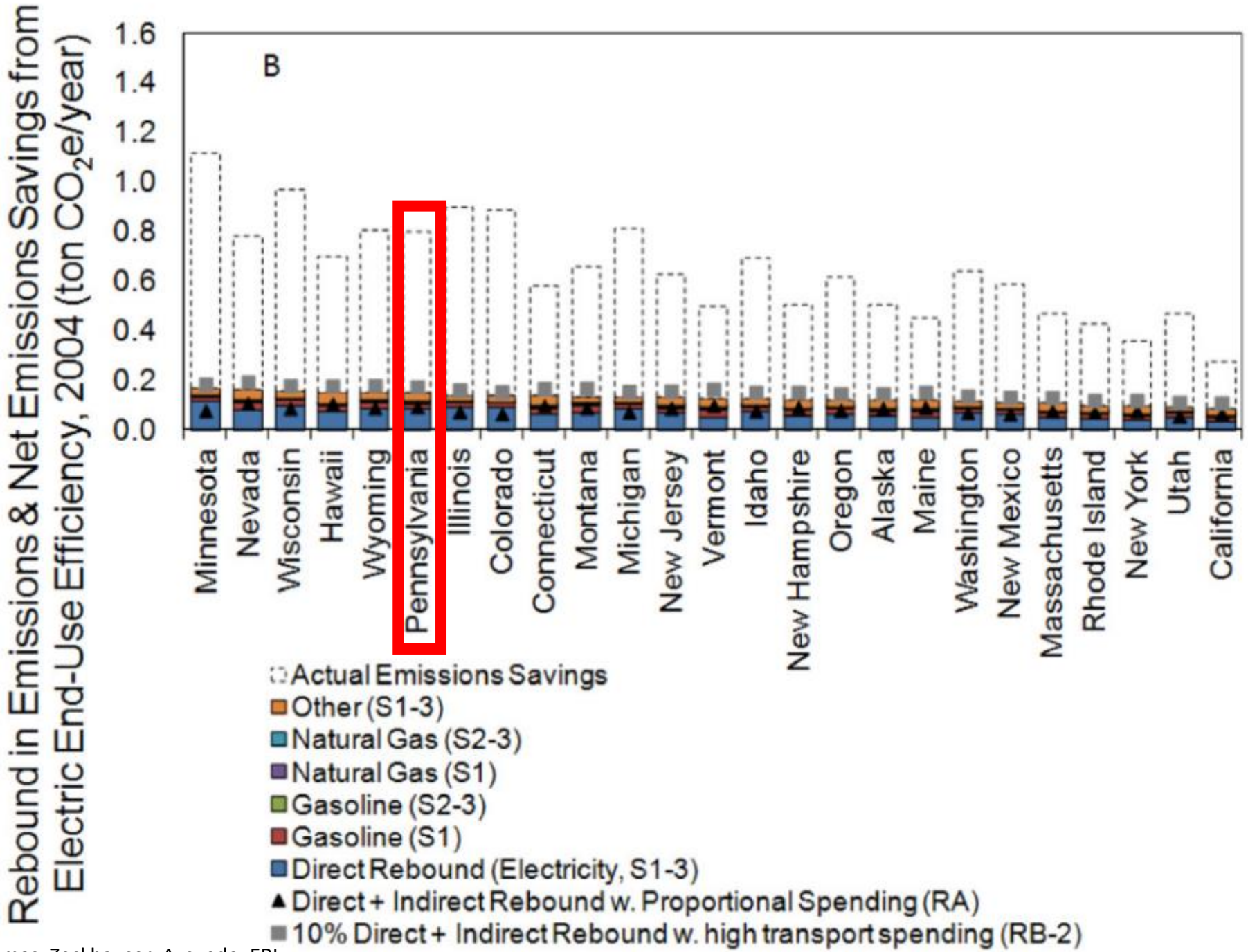

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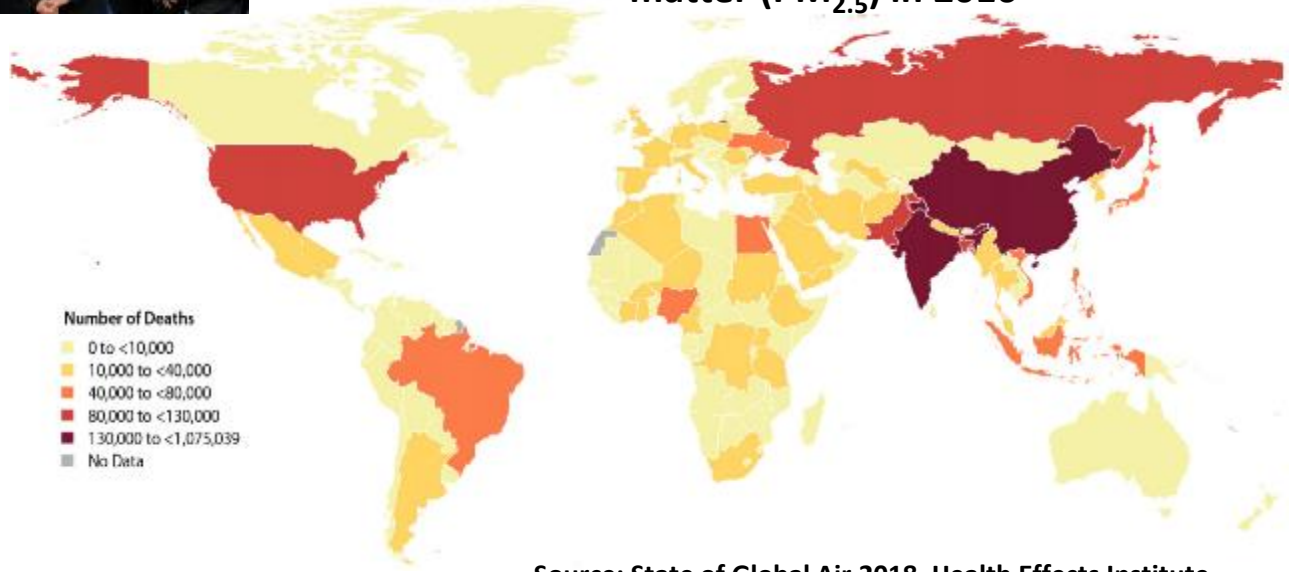
5. To understand the impacts of emissions we may need very geographical and temporally specific emissions data.

Electricity services are responsible for greenhouse gas emissions and substantial air quality and health impacts

Deaths attributable to fine particulate matter ($PM_{2.5}$) in 2016



Source: State of Global Air 2018, Health Effects Institute

Slide from B. Sergi

Questions

How do U.S. individuals value **tradeoffs** across climate change, air quality, and the cost of electricity?

How does providing information related to **climate** or **health** affect respondents' preferences?

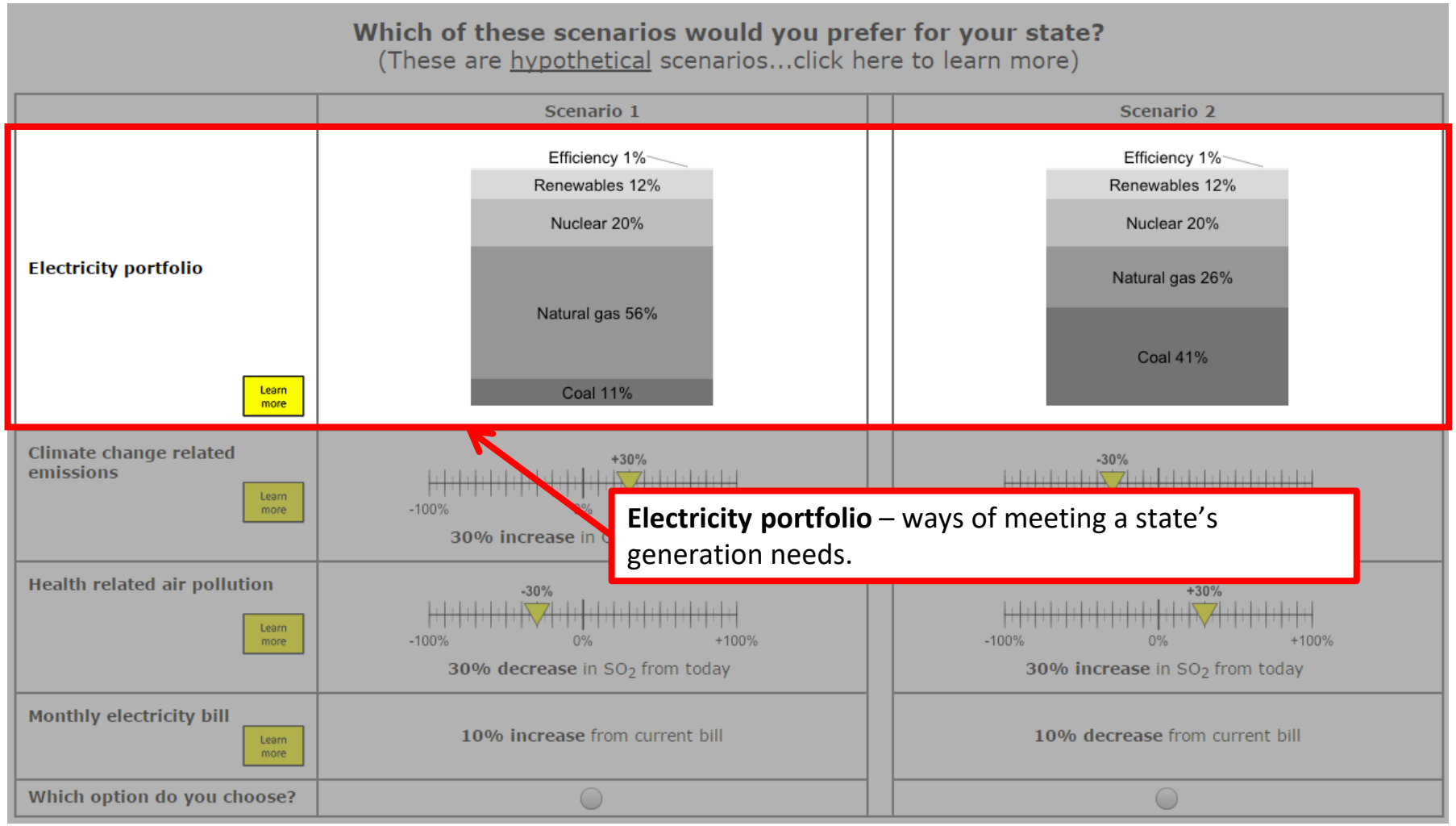
Slide from B. Sergi

Individuals respond to many comparisons of discrete electricity “futures” with up to four different attributes

Which of these scenarios would you prefer for your state?
(These are hypothetical scenarios...click here to learn more)

	Scenario 1	Scenario 2
Electricity portfolio Learn more	Efficiency 1% Renewables 12% Nuclear 20% Natural gas 56% Coal 11%	Efficiency 1% Renewables 12% Nuclear 20% Natural gas 26% Coal 41%
Climate change related emissions Learn more	+30% -100% 0% +100% **30% increase** in CO_2 from today	-30% -100% 0% +100% **30% decrease** in CO_2 from today
Health related air pollution Learn more	-30% -100% 0% +100% **30% decrease** in SO_2 from today	+30% -100% 0% +100% **30% increase** in SO_2 from today
Monthly electricity bill Learn more	**10% increase** from current bill	**10% decrease** from current bill
Which option do you choose?	○	○

Slide from B. Sergi



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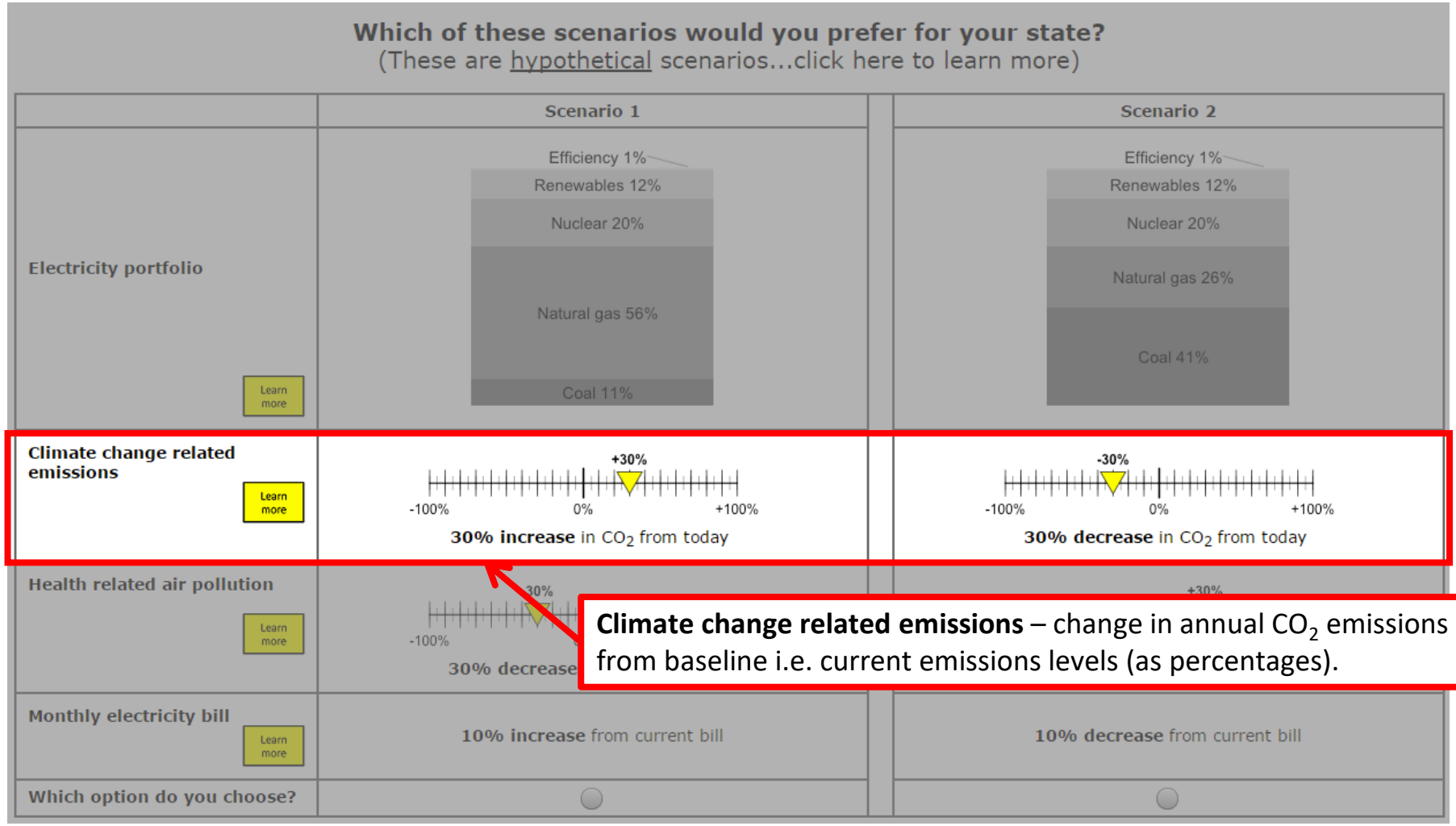

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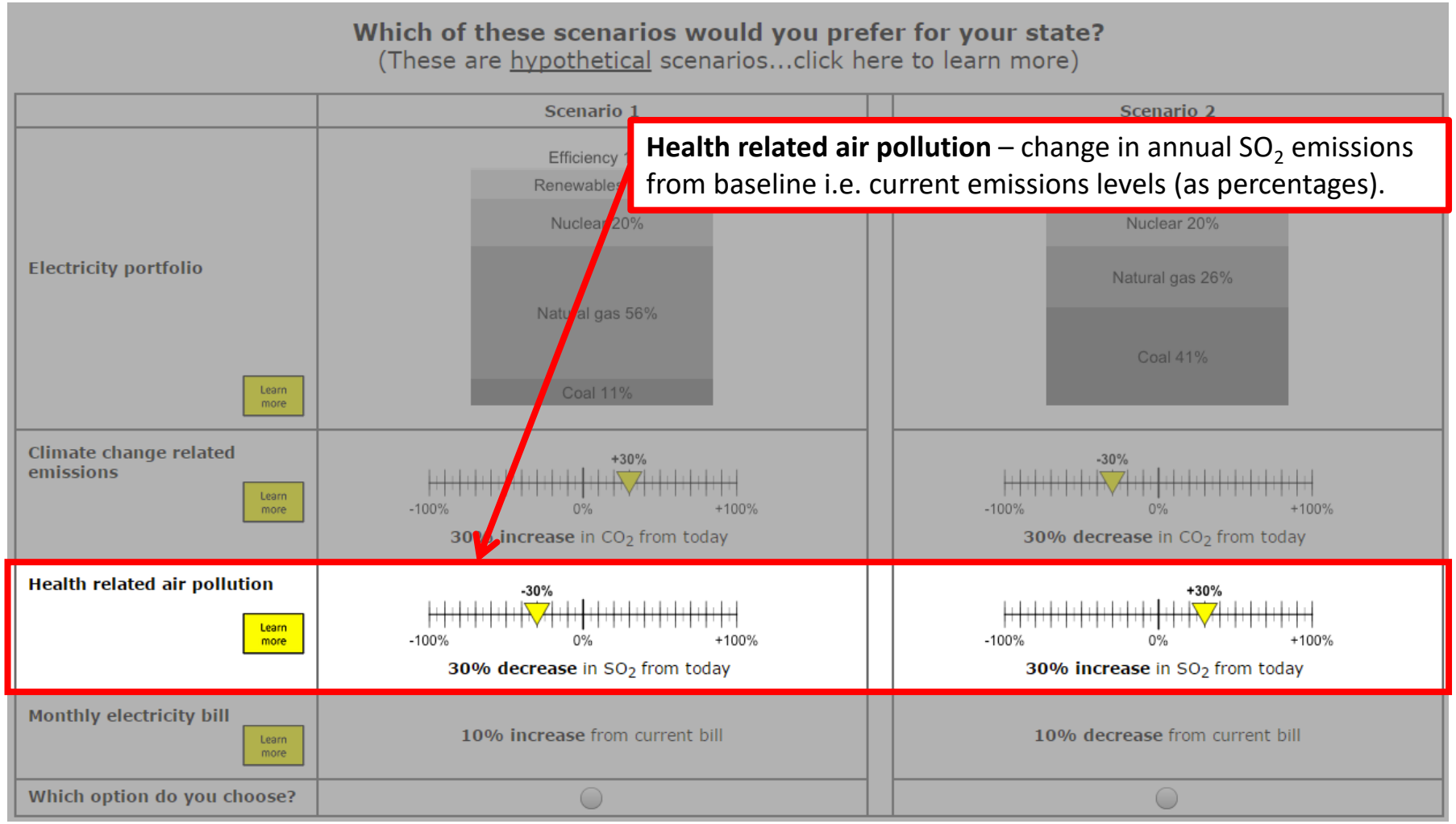

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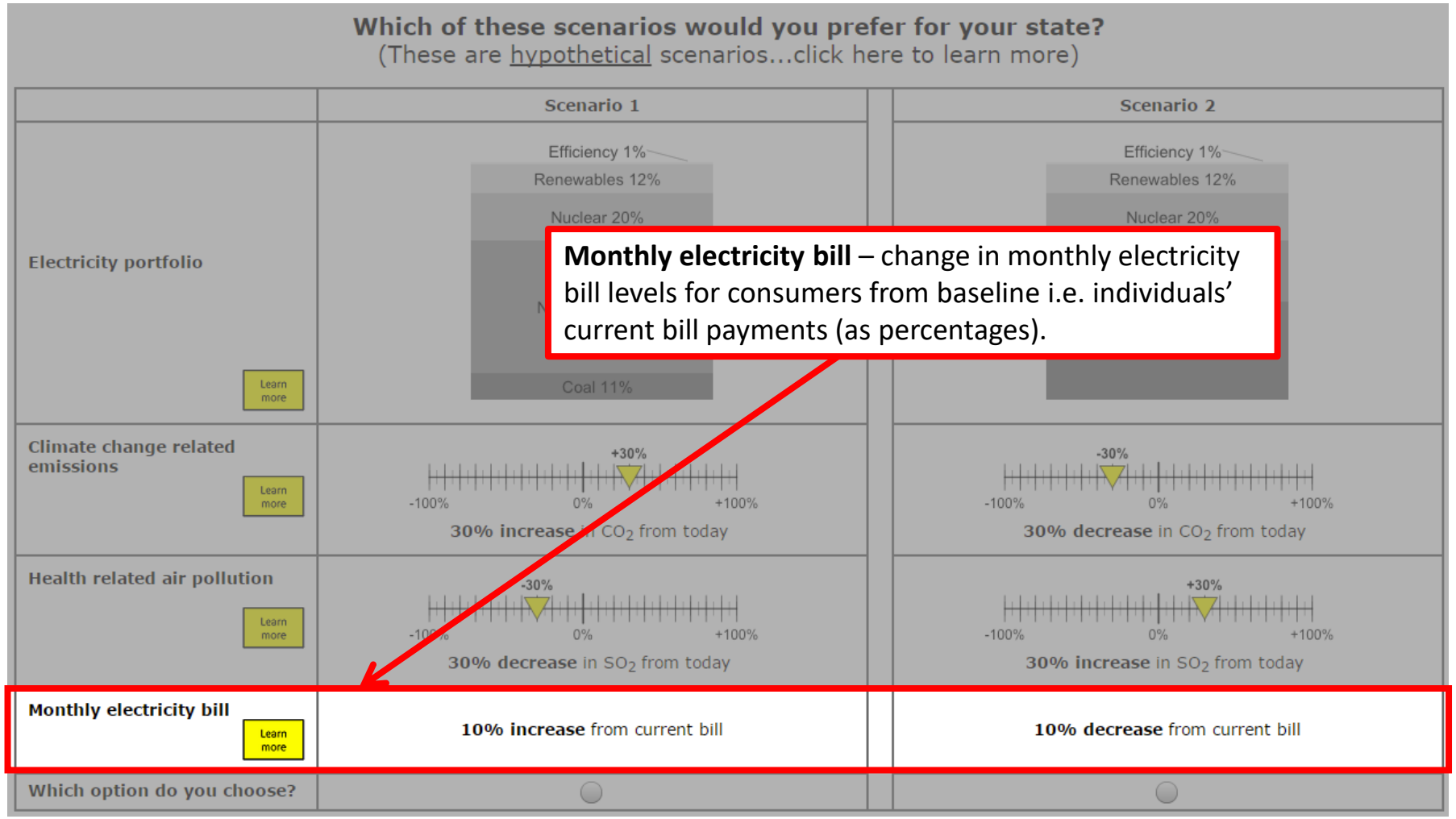

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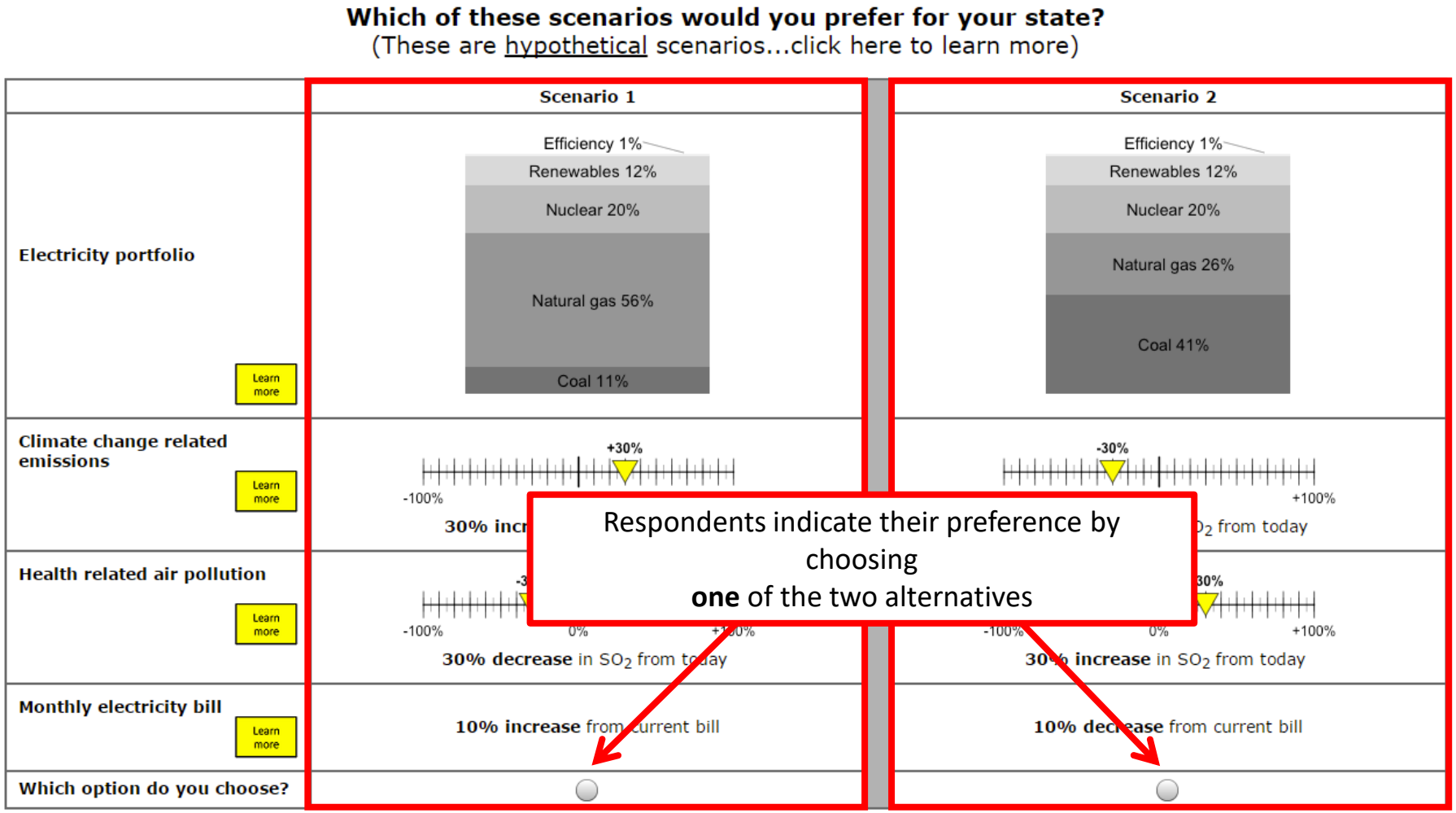


Slide from B. Sergi

Experimental design for evaluating the effect of climate and health information

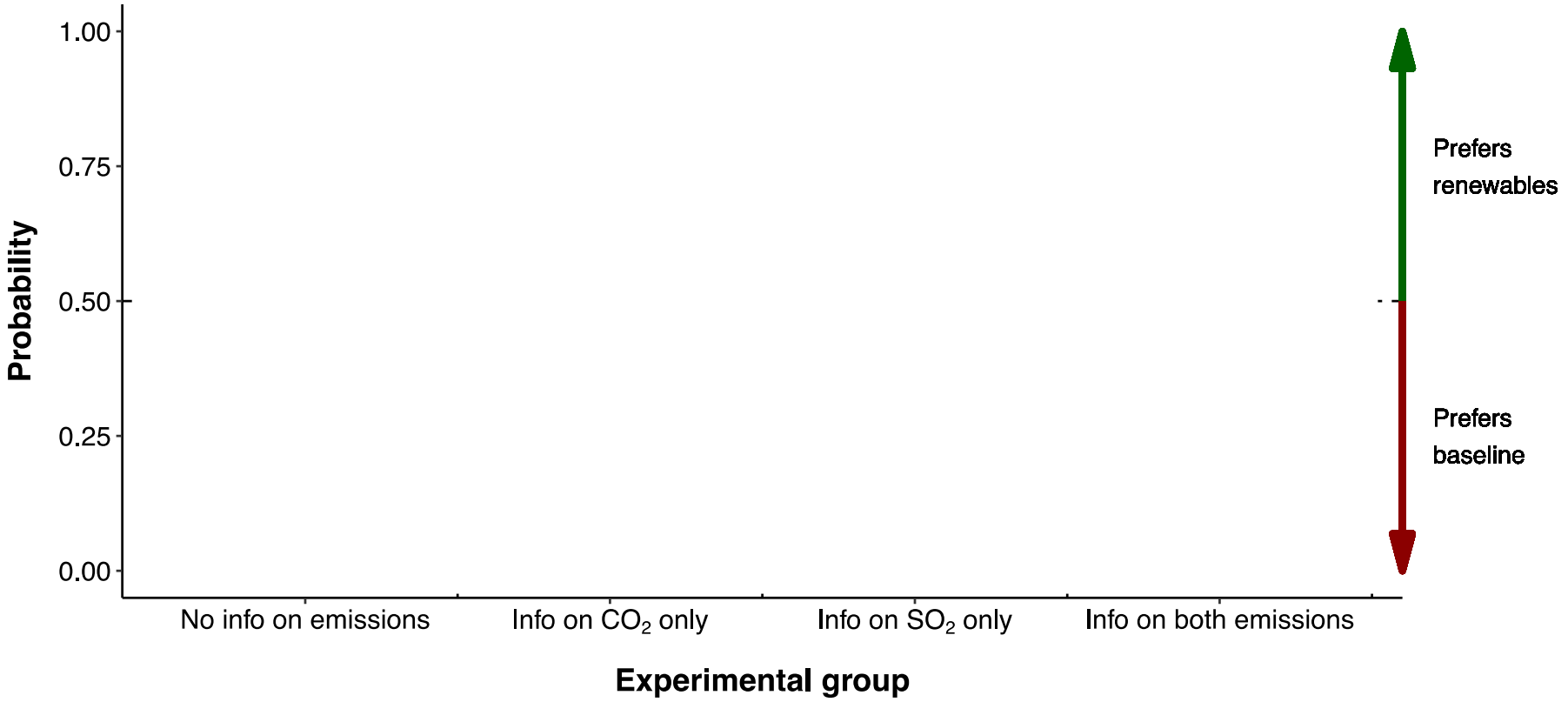
Randomized controlled trial with different emissions attributes shown in the task.

Respondents assigned to one of four groups, where they see…

	Portfolio	Bill	CO_2	SO_2
Group 1: No info on emissions	✓	✓		
Group 2: CO_2 only	✓	✓	✓	
Group 3: SO_2 only	✓	✓		✓
Group 4: Info on both	✓	✓	✓	✓

Slide from B. Sergi

When emissions information is shown, people show more support for renewables, *even* if that entails a 20% increase in electricity bills



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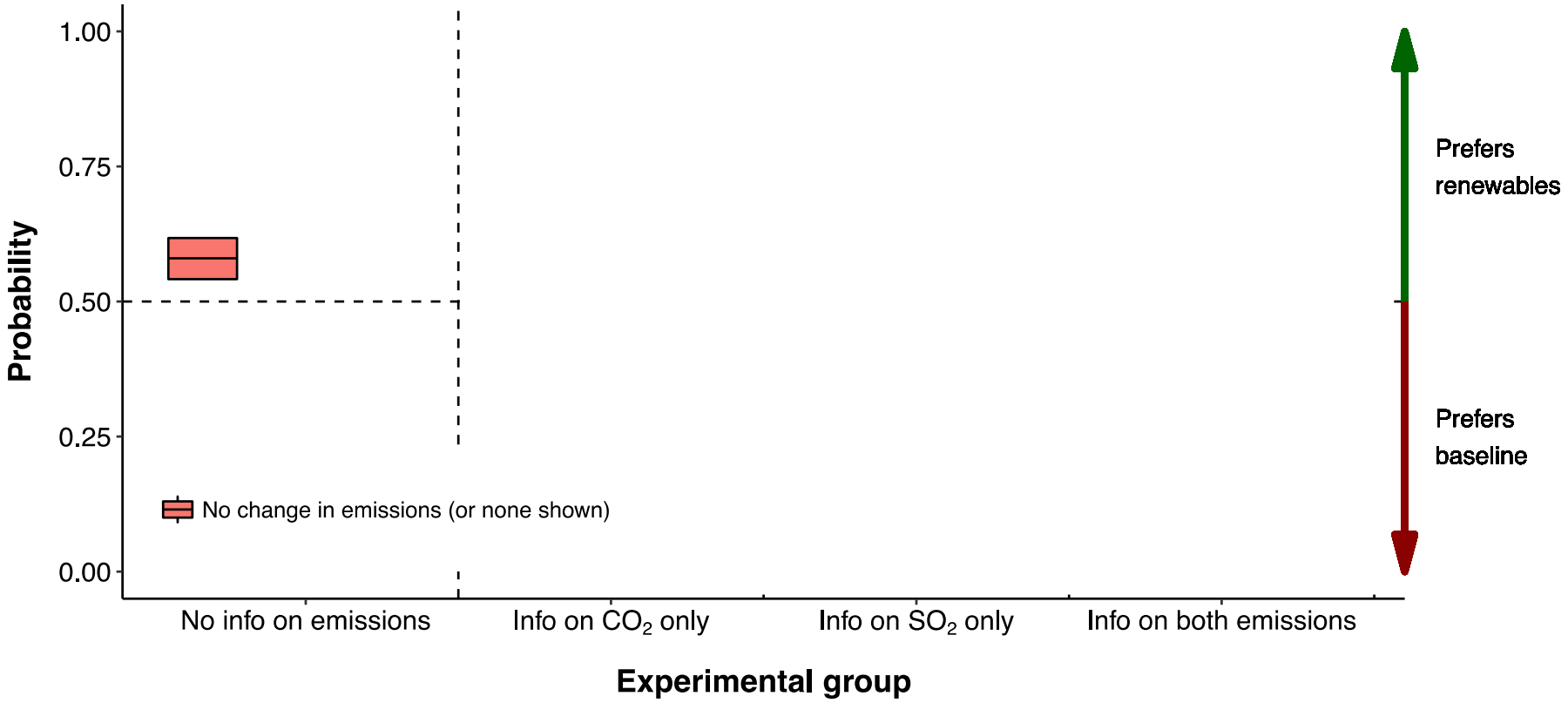

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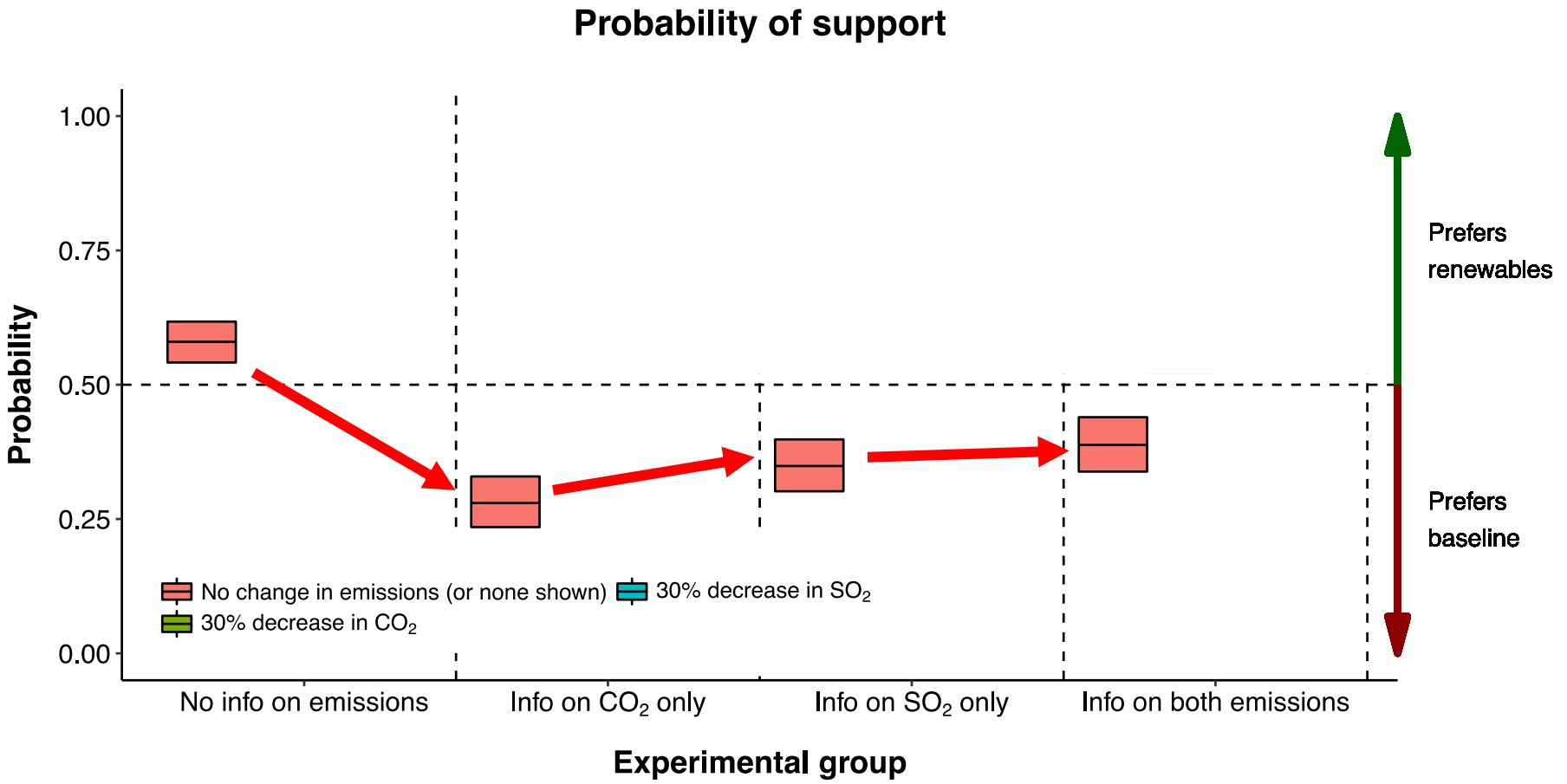
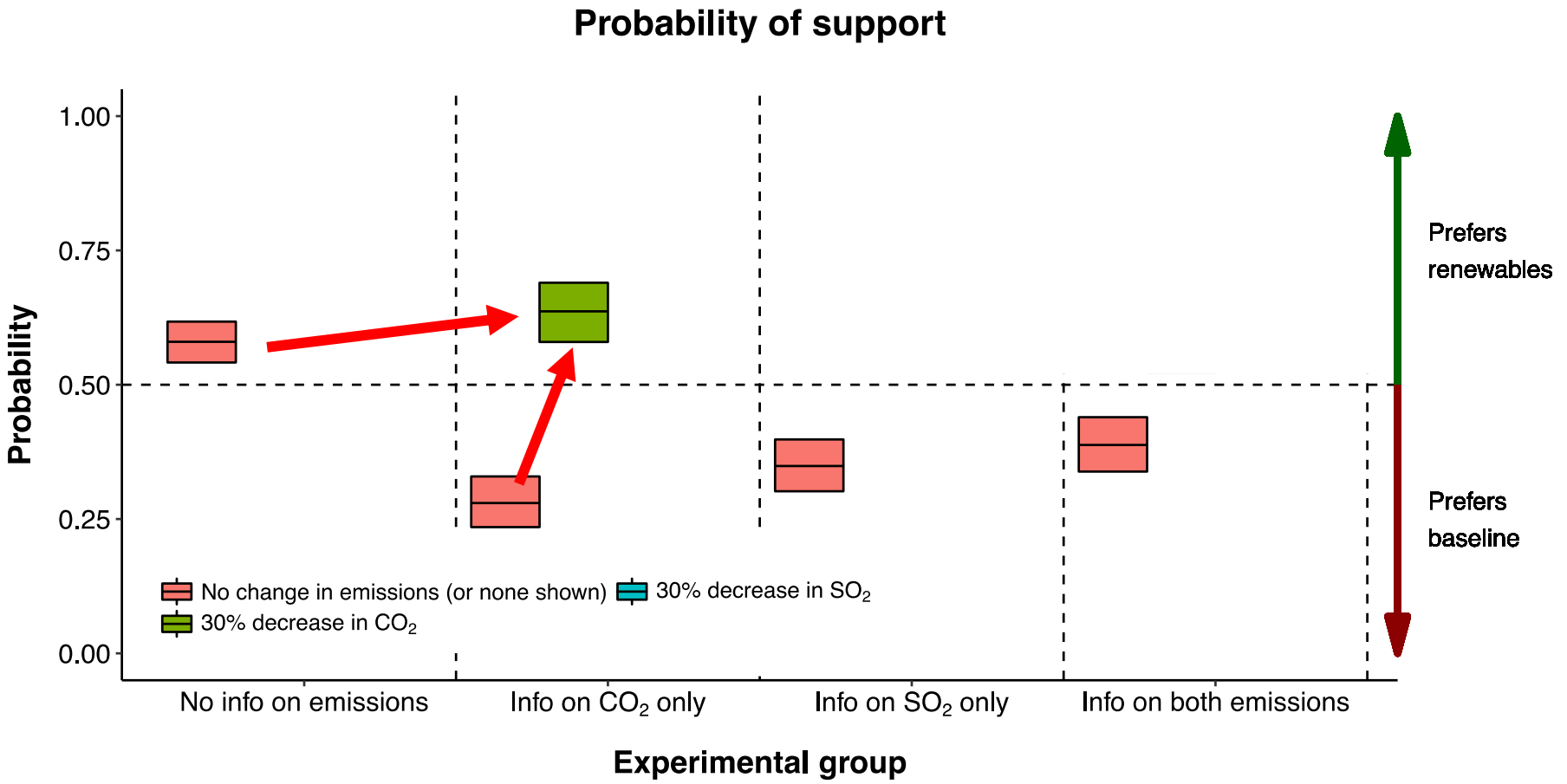
When information on emissions reductions is shown, people show more support for renewables, *even* if that entails a 20% increase in electricity bills



Slide from B. Sergi

When information on emissions reductions is shown, people show more support for renewables, *even* if that entails a 20% increase in electricity bills



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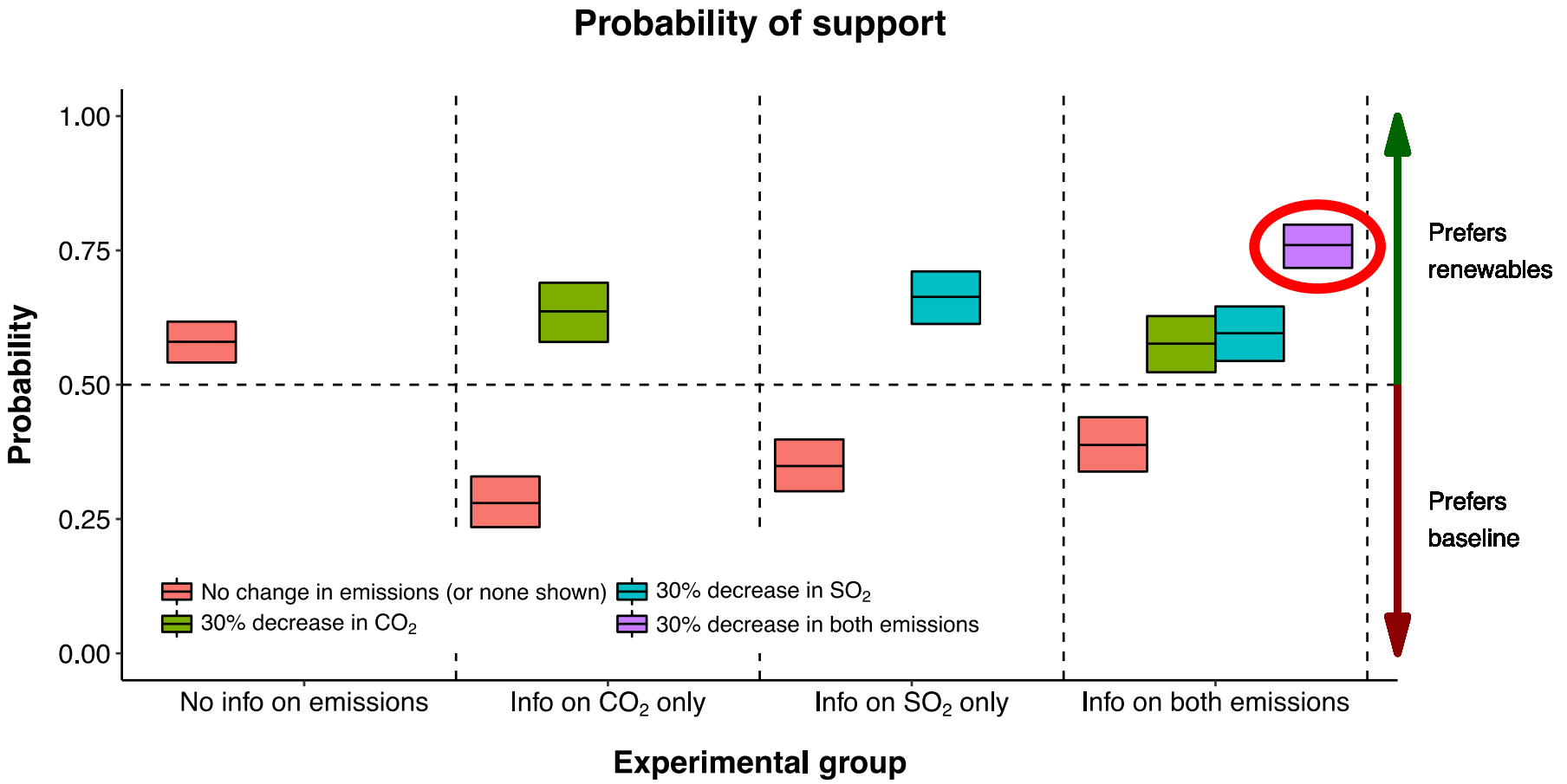


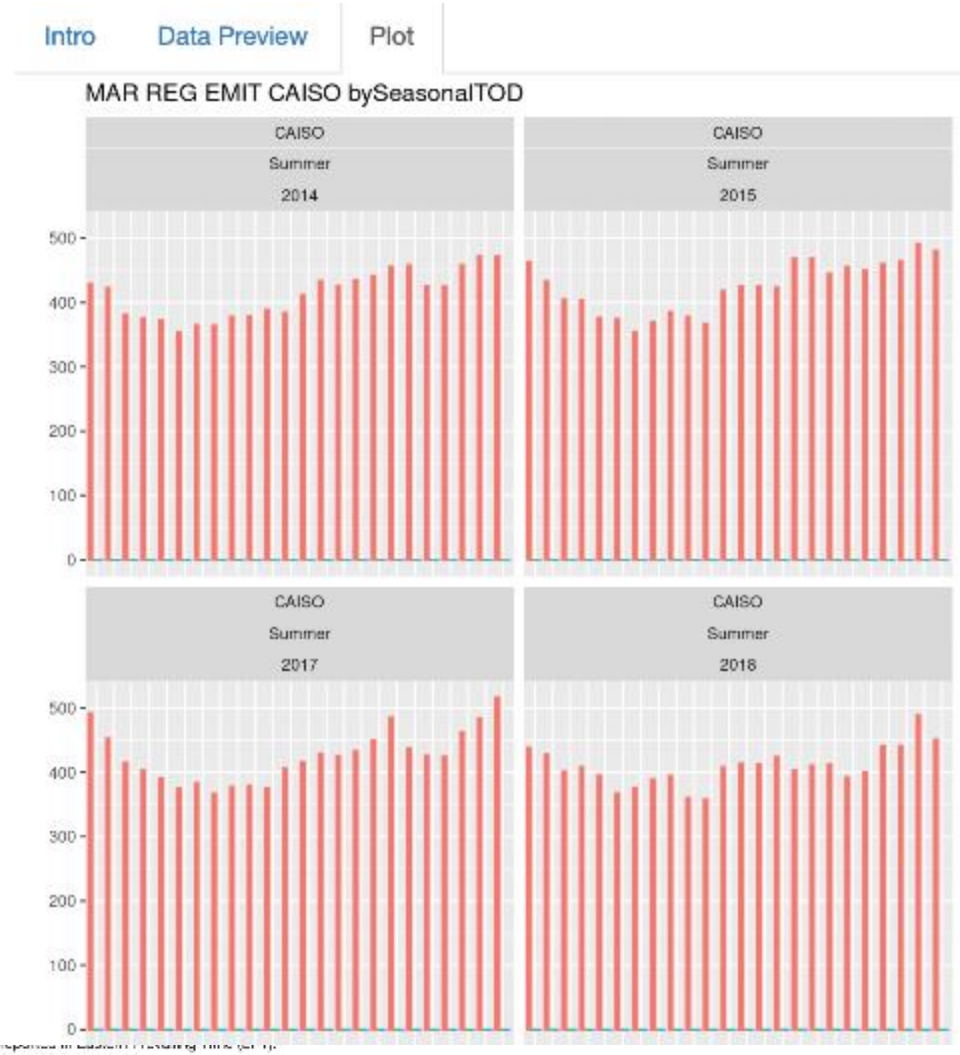
Slide from B. Sergi

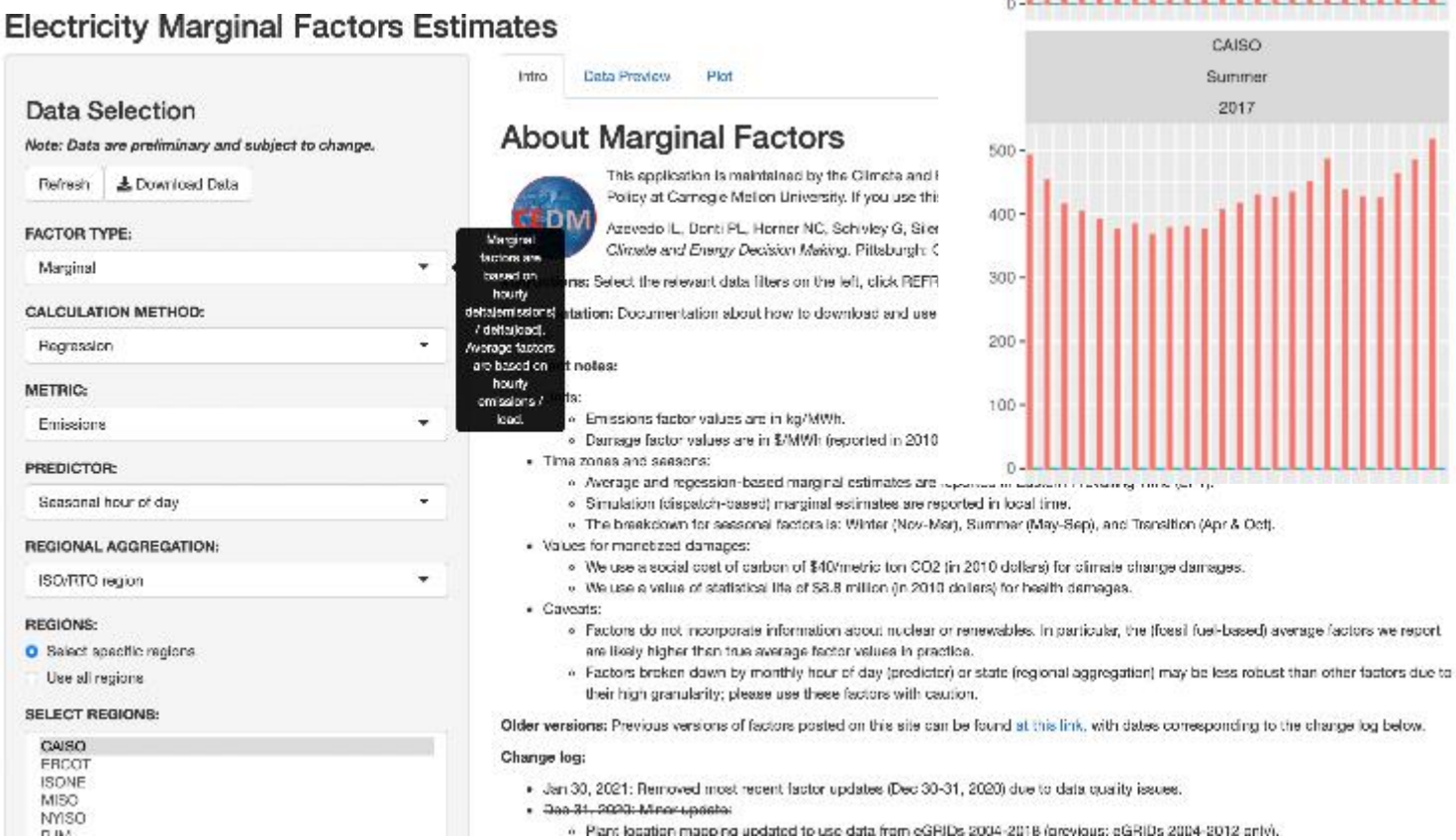
Key messages

1. People are not very good at assessing their energy consumption or carbon footprint.
2. Feedback on information may not be enough to change behavior.
3. Rebound effects may exist but the are likely small.
4. Providing information on co-benefits may help with better decision making.
5. To understand the impacts of emissions we may need very geographical and temporally specific emissions data.

We have developed such tools.

https://ines.stanford.edu





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Inês M.L. Azevedo

Associate Professor, Department of Energy Resources Engineering

Co-director, Bits & Watts Initiative Stanford

Senior Fellow, Woods Institute for the Environment

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Stanford University

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Reuven Sussman

American Council for an Energy-Efficient Economy

U.S. DEPARTMENT OF ENERGY

Energy Labels Affect Behavior on Rental Listing Websites: A Controlled Experiment

Reuven Sussman, Ph.D., Director, Behavior and Human Dimensions Program

Hannah Bastian, Research Analyst, Buildings Program

Also: Steven Conrad, Emma Cooper, Elizabeth Tong, Ang Sherpa, and Shiva Pourfalatoun

Better Buildings Peer Exchange Webinar – August 11, 2022

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Download the full report from ACEEE website:
https://www.aceee.org/research-report/b2204

Surprised by your energy bill?

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What we wanted to learn

Do renters choose more efficient rental units when listings contain energy efficiency information?

Which labels are most effective?

Which renters value energy efficiency the most?

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The Experiment

- Simulate rental listing search results
- Control rental listing attributes
- Display efficiency information in different ways
  - Control group – no information
- Ask renters to pick their preferred homes
- Calculate
  - Likelihood of clicking on efficient listings
  - Willingness to raise rental price for efficiency

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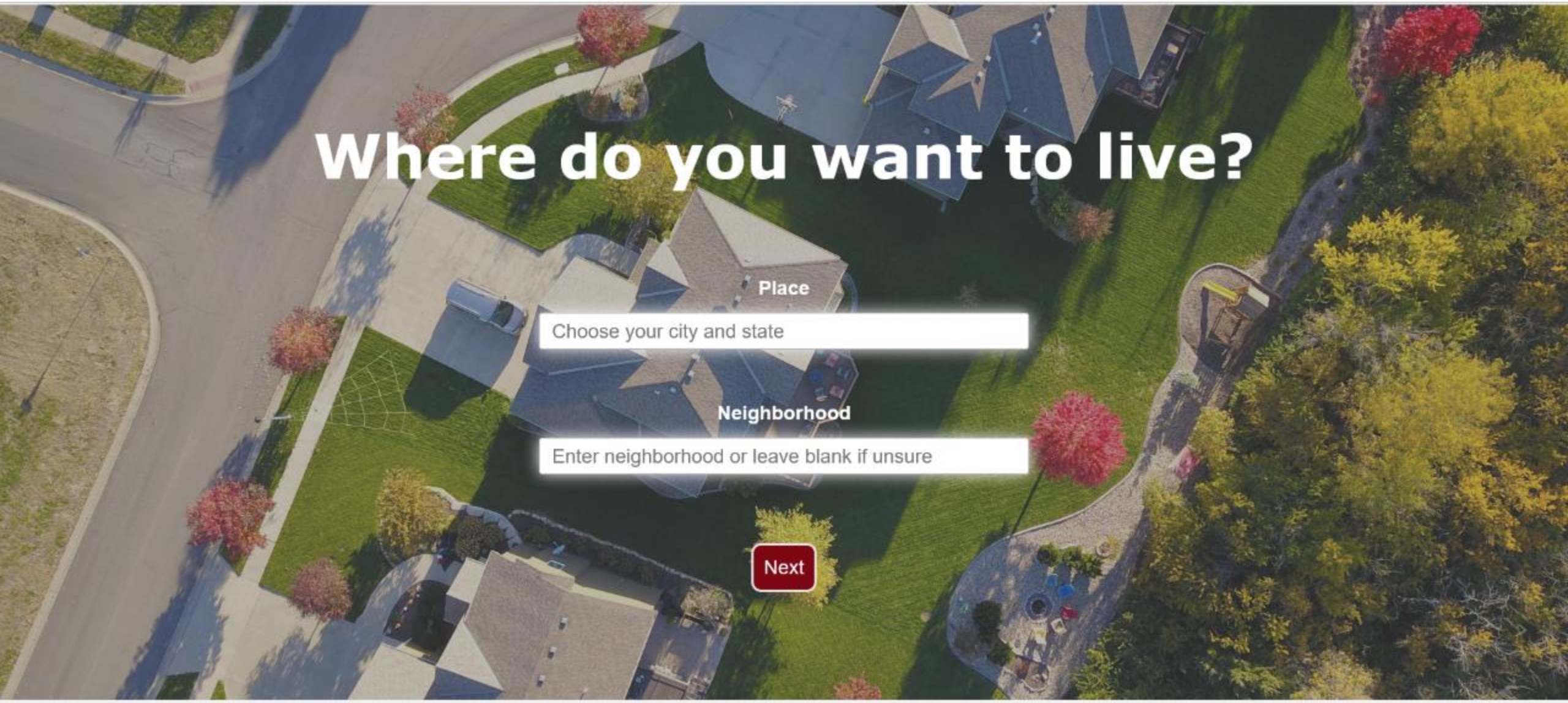
RentDragon


Where do you want to live?
Place
Choose your city and state
Neighborhood
Enter neighborhood or leave blank if unsure
Next

RentDragon

My expected rent

$ _____ per month

Property Type

Apartment

House

Preferred number of Bedrooms

1 2 3 4

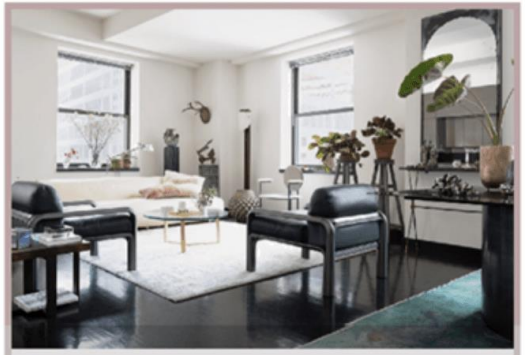
Next

RentDragon

Detroit, MI | $1200 | Beds: 2 | Apartments

Apartments in Sherwood Forest, Detroit MI

$1,239 /month
2 bedrooms | **1.5** bathrooms | **1075** square feet



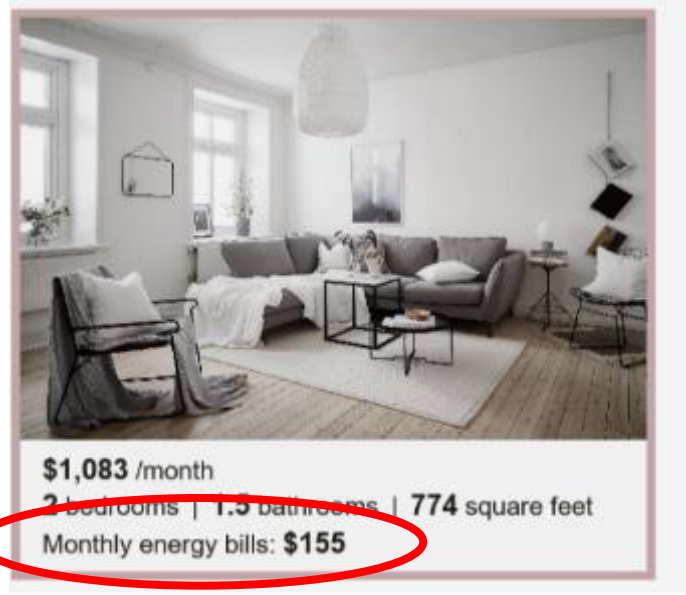
$1,317 /month
3 bedrooms | **2** bathrooms | **1376** square feet

$1,083 /month
2 bedrooms | **2.5** bathrooms | **774** square feet

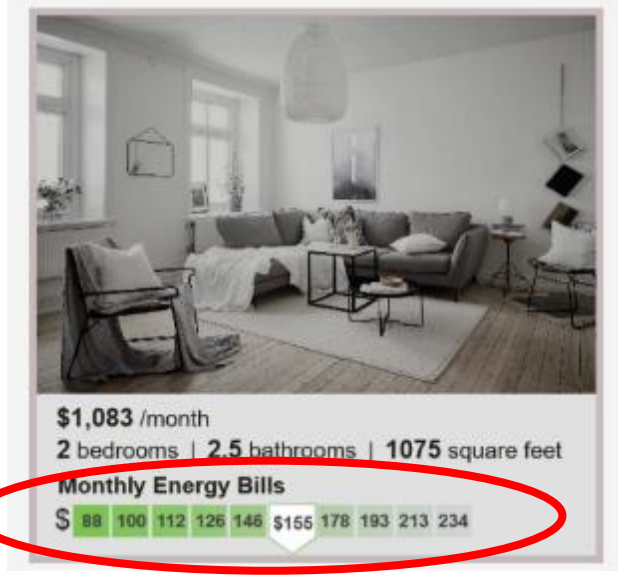
1 2 ... 6

Next

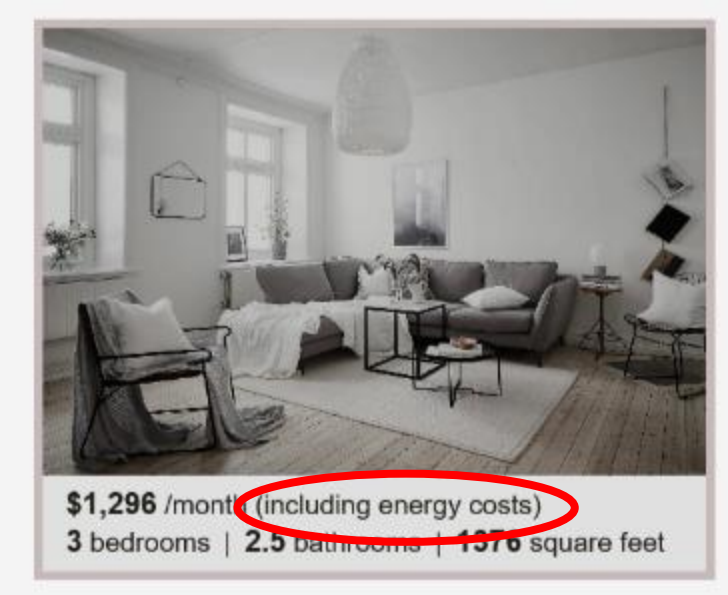
Conditions: Energy Cost Labels



Estimated Energy Costs



Energy Costs Along a Continuum



Energy Costs Included In Rent

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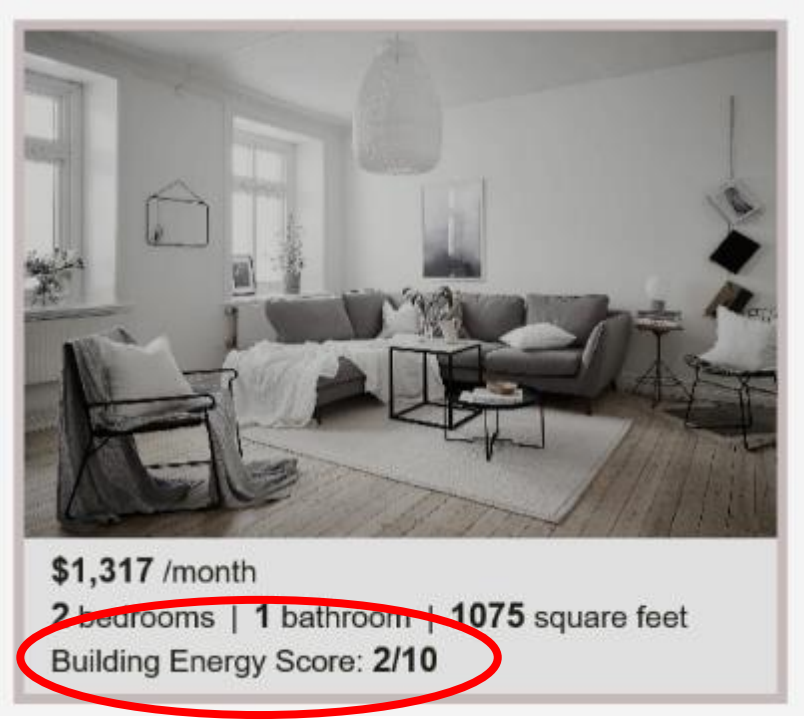
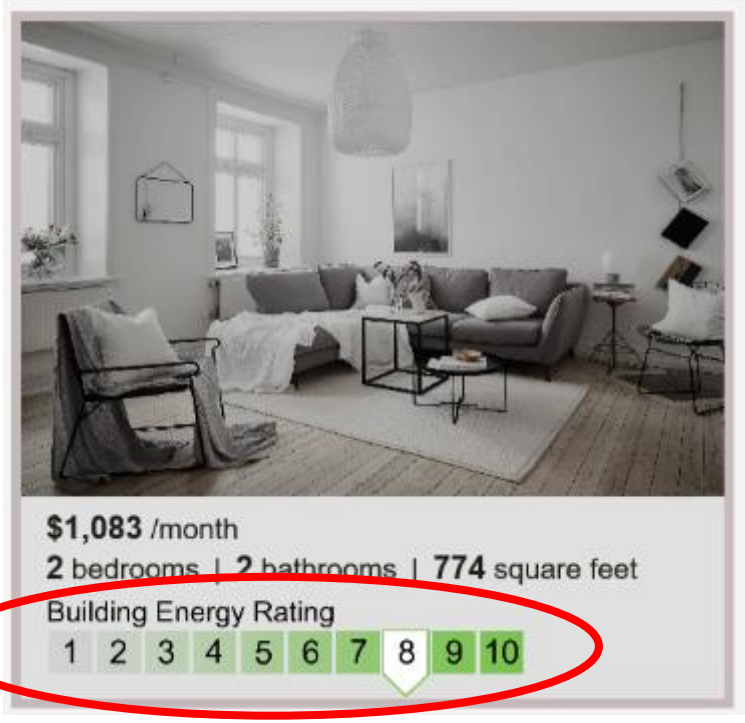
Conditions: Energy Score Labels



Energy Score Out of 10



Energy Score on a Continuum

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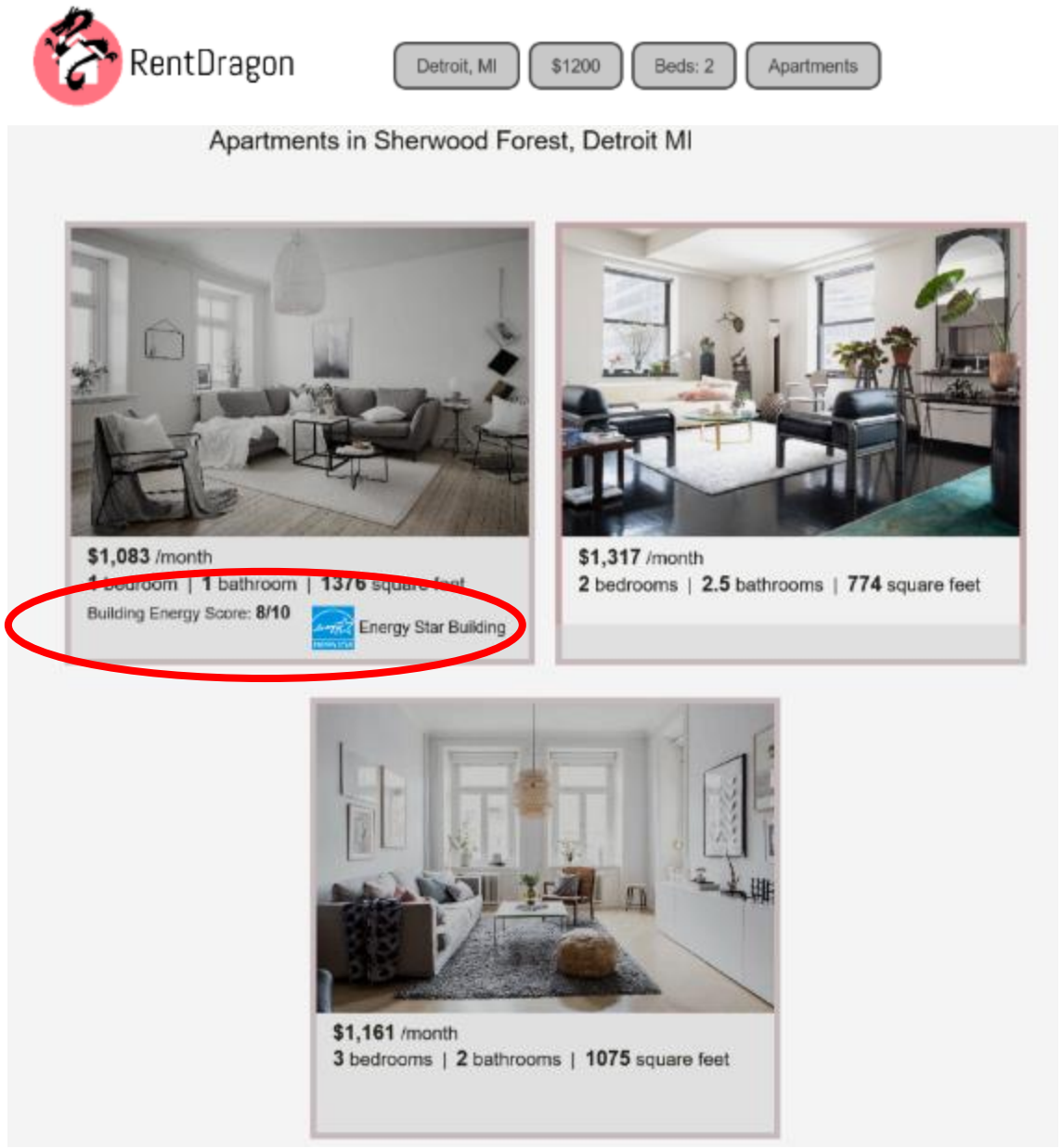
Condition: Voluntary Label



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Do renters choose more efficient rental units when listings contain energy efficiency information?

Yes! Energy Information Affects Decisions!

Selected 21% more often

Selected 21% less often

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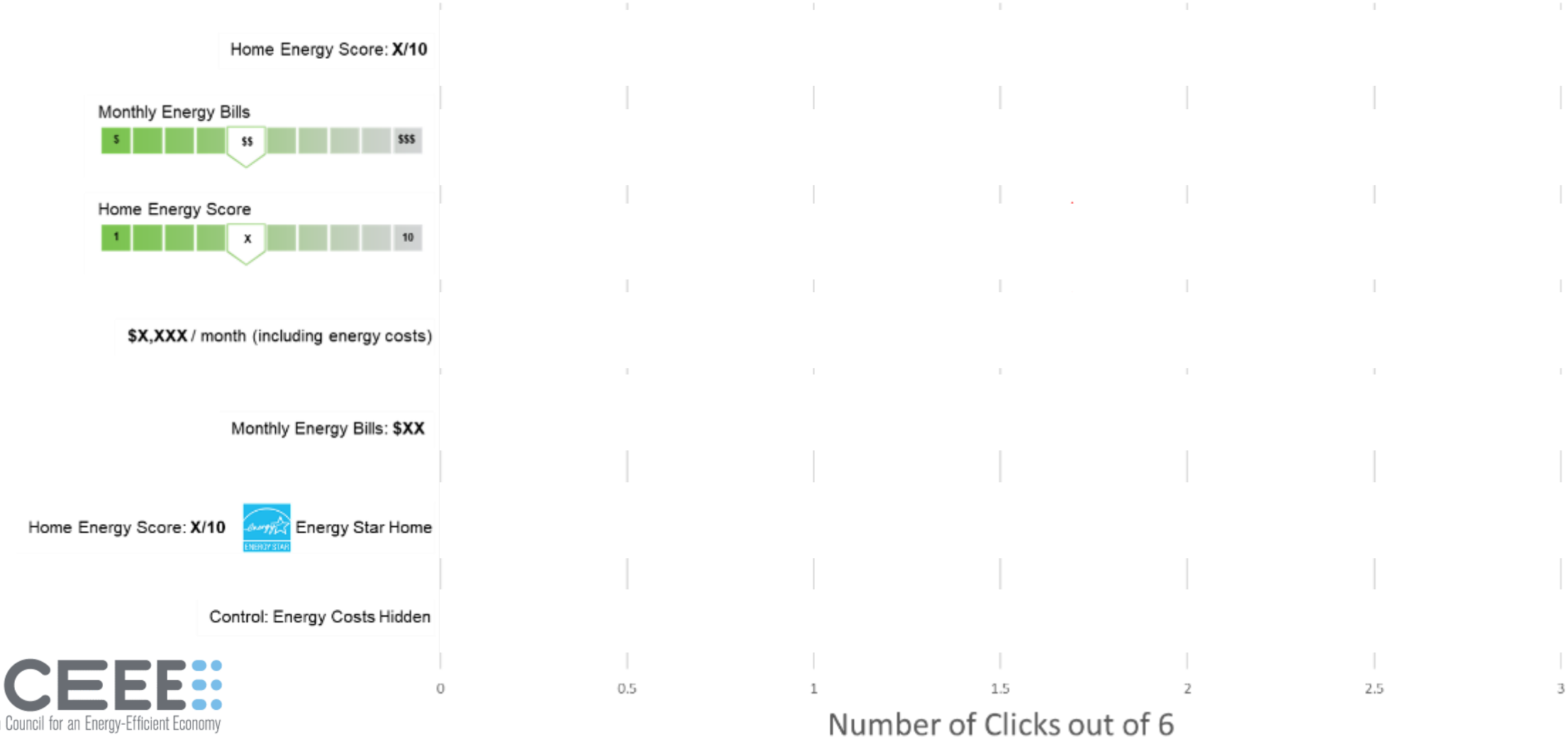
Which labels are most effective?

Choosing the most efficient option



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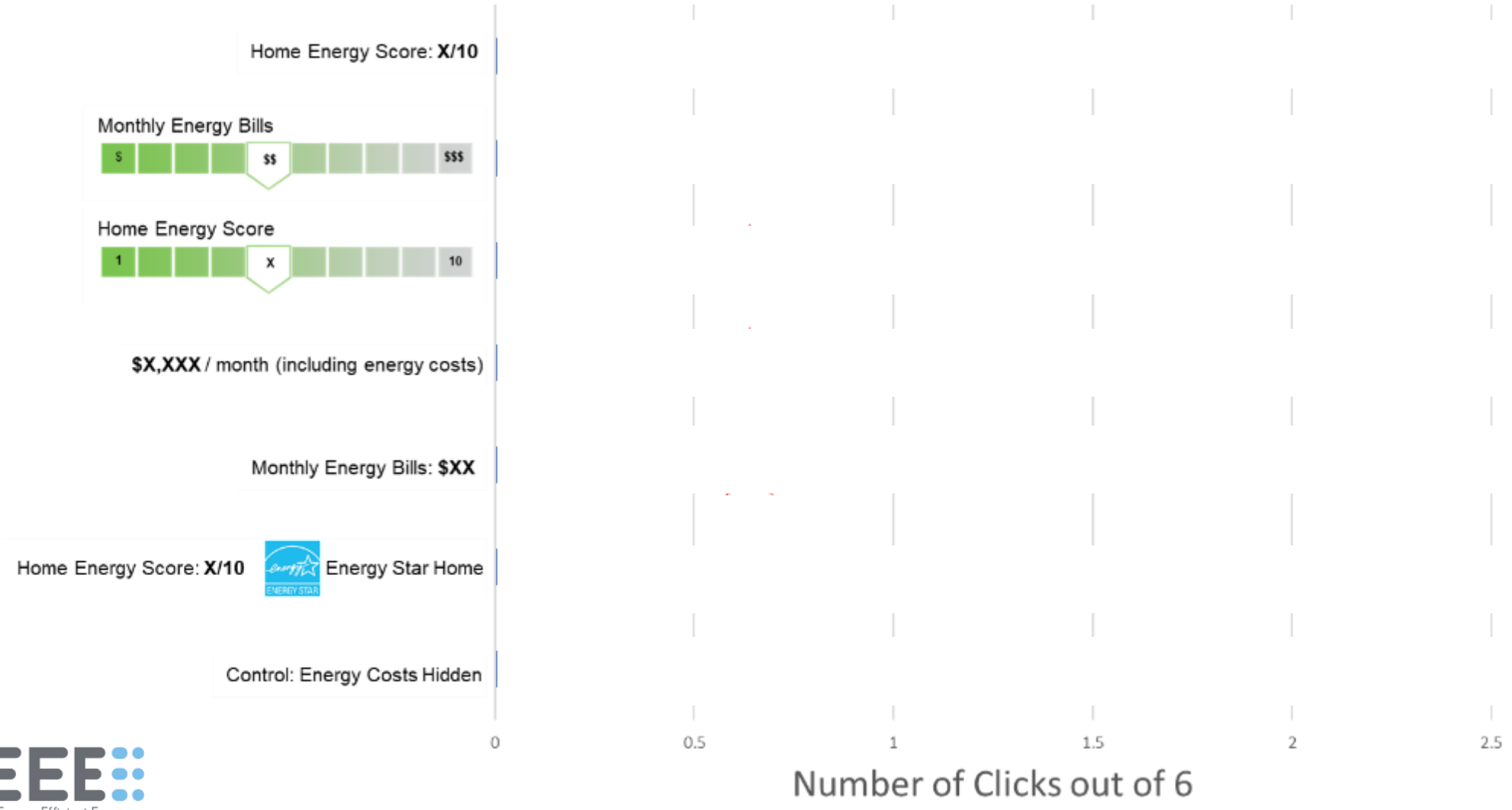
Choosing the least efficient option



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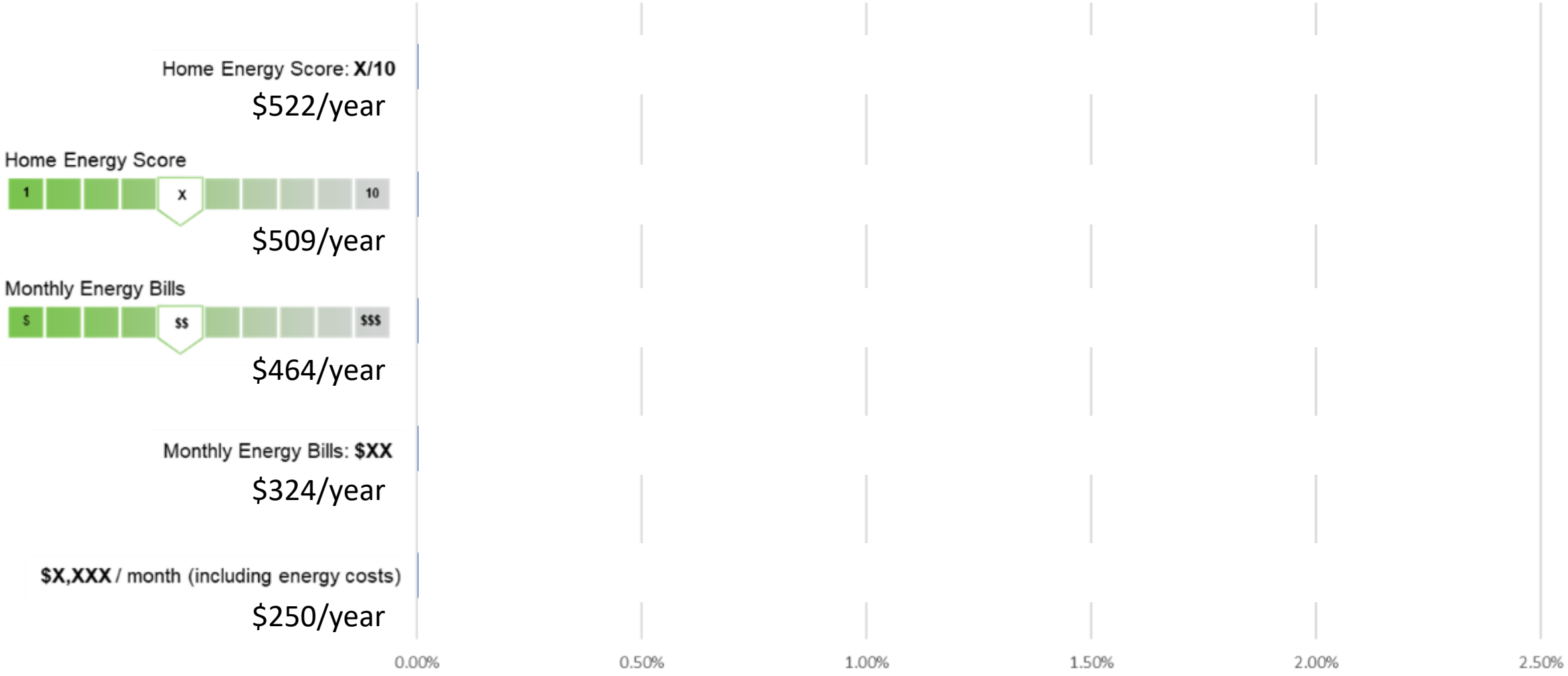
Percent willingness to increase rental price for one unit increase in efficiency



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*Average rent in 2021 = $1,877 (Bhattarai 2022)

Which Renters Value Energy Efficiency the Most?

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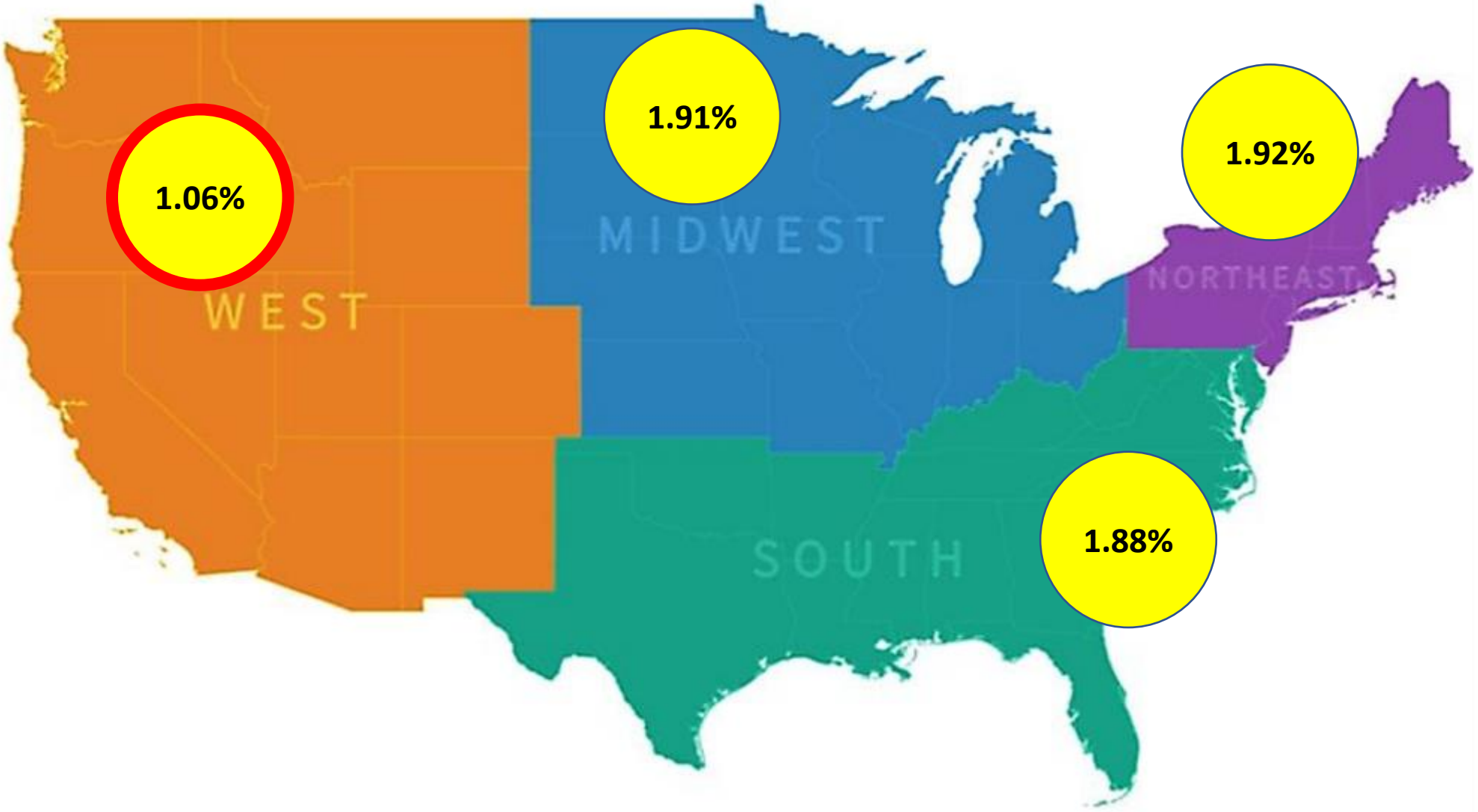
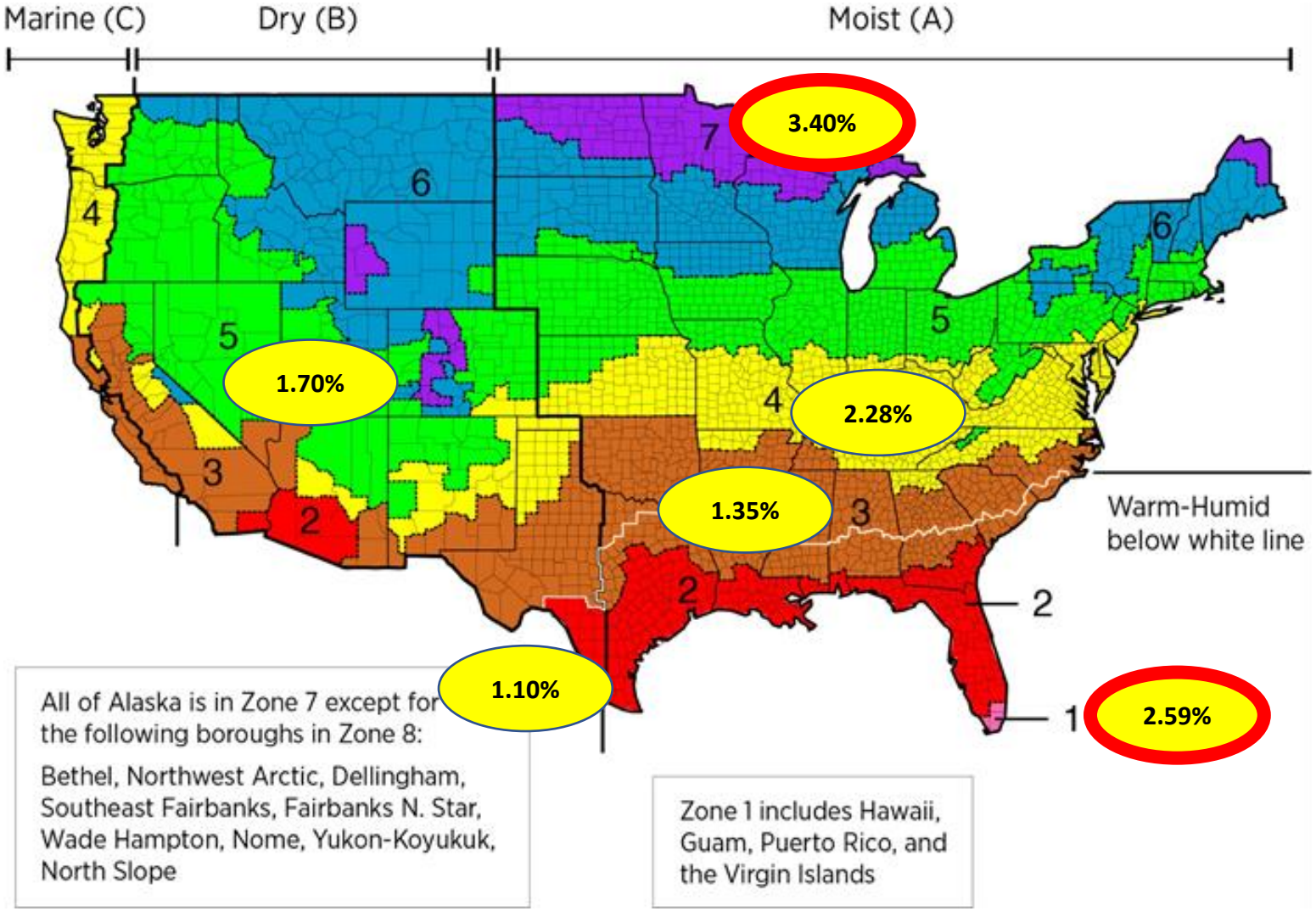
Renters in West Willing to Pay Least



Renters in Hottest and Coolest Climates Willing to Pay Most



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Apartment Renters

	House	Apartment
Monthly rent	$1,354	$1,221
WTP for 3 units [SD]	$65.99 [5.12]	$69.75 [4.0]
WTP for 1 unit	$22.00	$23.25
WTP as a percentage of rent	1.62%	1.90%
Annual revenue increase for 3-unit improvement	$791.88	$837.00

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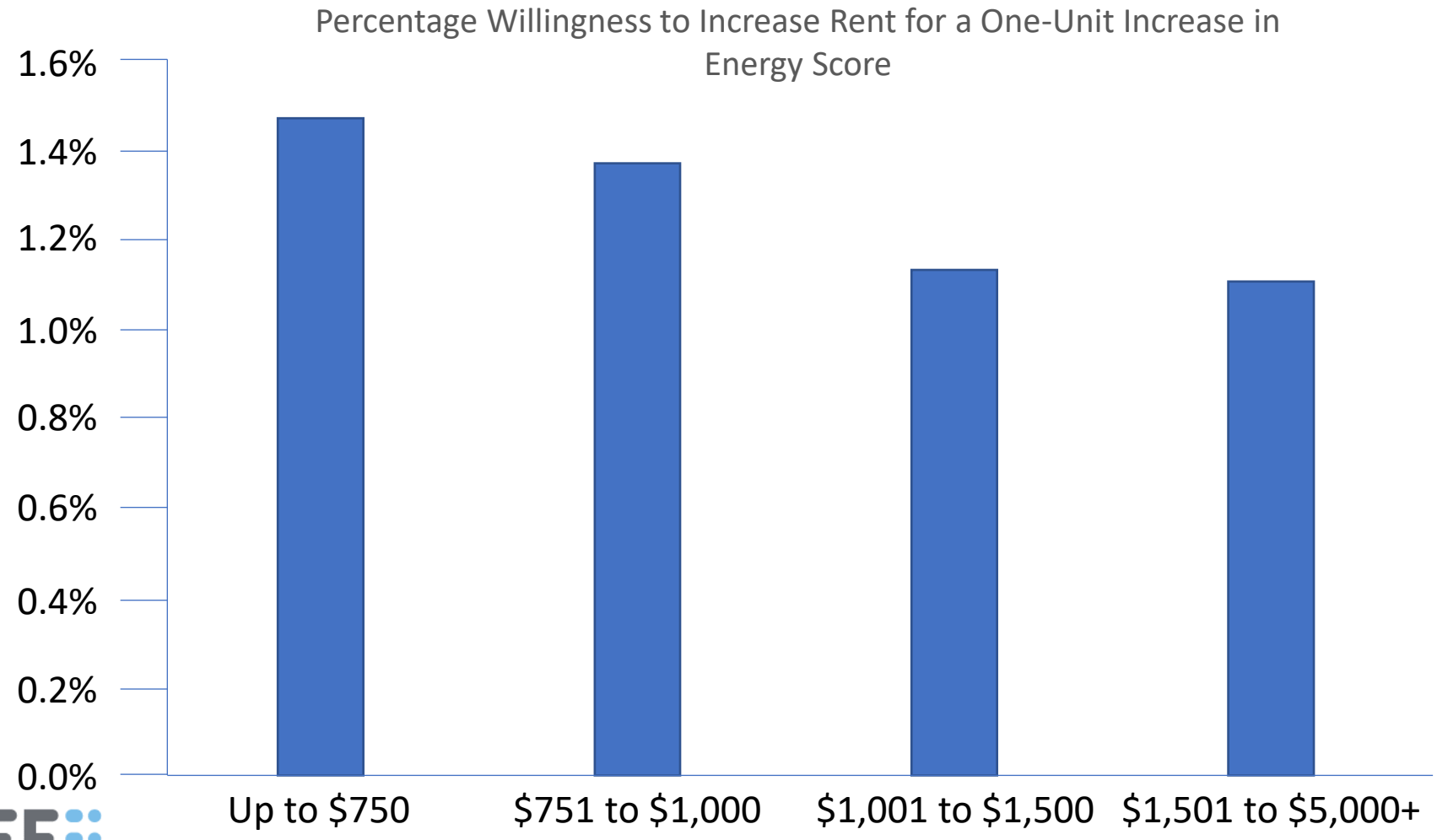
Intended Rental Price



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Key Takeaways

Energy efficiency information = clicking more efficient rentals

Voluntary labeling (only most efficient) was less effective

High-context labels are best

Apartment renters, lower-priced rentals willing to pay higher percentage rent increase for efficiency

Renters in milder climates may pay less than hot or cold climates

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Policy Recommendations

- Require disclosure of energy-use information at time of listing
- Use a multipolicy approach
- Move toward context-rich labels and away from voluntary labels, if possible
- Use an intuitive rating system

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ciee California Institute for Energy and Environment

CITRIS and the BANATAO INSTITUTE

Stanford Environmental and Energy Policy Analysis Center

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Download the report: https://www.aceee.org/research-report/b2204

Thank you!

Dr. Reuven Sussman, Director, Behavior and Human Dimensions Program, ACEEE, rsussman@aceee.org

Hannah Bastian, Research Analyst, Buildings Program, ACEEE, hbastian@aceee.org

Explore the Residential Program Solution Center

Resources to help improve your program and reach energy efficiency targets:

- Handbooks - explain *why* and *how* to implement specific stages of a program.
- Quick Answers - provide answers and resources for common questions.
- Proven Practices posts - include lessons learned, examples, and helpful tips from successful programs.
- Technology Solutions NEW! - present resources on advanced technologies, **HVAC** & **Heat Pump Water Heaters**, including installation guidance, marketing strategies, & potential savings.
- Health + Home Performance Infographic NEW! – spark homeowner conversations.

https://rpsc.energy.gov

Health + Home Performance Infographic

DOE's new Health + Home Performance Infographic reveals the link between efficiency and health – something everyone cares about. Efficiency programs and contractors can use the question-and-answer format to discover a homeowner's needs.

The infographic is ideal for the "kitchen table" conversations where people decide what to do – and who they want to do it. It also has links for homeowners to find a qualified contractor if they do not already have one.

Download this infographic from DOE's Better Buildings Residential Network.

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